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# STATIC AND DYNAMIC STABILITY IN DOMESTIC CRICKETERS WITH LOWER LIMB MUSCLE CRAMPS

*Original Research*

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## ABSTRACT

**Background:** Muscle cramps, particularly in the lower extremities, are frequently reported among athletes and can significantly impair postural control and athletic performance. Cricketers, due to prolonged physical exertion and repetitive motion, are highly susceptible to such cramps, which can lead to disturbances in both static and dynamic stability. Understanding the association between cramp severity and balance deficits is essential for developing preventive strategies aimed at optimizing player performance and reducing injury risk.

**Objective:** To evaluate the relationship between lower limb muscle cramp severity and static and dynamic stability among domestic cricketers.

**Methods:** A cross-sectional study was conducted among 169 domestic cricketers aged 18–35 years. Participants were assessed using the Muscle Cramp Questionnaire to evaluate cramp characteristics including frequency, duration, severity, and site. Static balance was measured via the Stork Balance Test, while dynamic balance was assessed using the Star Excursion Balance Test. Data were analyzed using SPSS version 26.0. Chi-square tests were applied to identify associations between cramp severity and balance performance.

**Results:** Among the participants, 130 (76.9%) were male and 39 (23.1%) were female, with a mean age of 21.22 ± 3.15 years. Right leg dominance was reported in 110 (65.1%) individuals. Cramps occurred daily in 77 (45.6%) cases, with 110 (65.1%) experiencing cramps lasting over one hour, primarily affecting the thigh (52.1%). Most cramps occurred at night (40.2%), and moderate severity was reported by 114 (67.5%) participants. Statistically significant associations were found between muscle cramp severity and both static and dynamic balance on the dominant leg ($P < 0.05$), whereas no significant association was observed on the non-dominant leg ($P > 0.05$).

**Conclusion:** Moderate lower limb muscle cramps are common among domestic cricketers and are significantly associated with impaired balance, particularly on the dominant leg. Early detection and targeted training are essential for mitigating their impact.

**Keywords:** Athletic performance, Balance tests, Cramp severity, Cricketers, Dynamic balance, Lower limb, Static stability.

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## INTRODUCTION

Cricket, often referred to as “the gentleman’s game,” has evolved into a high-intensity sport demanding exceptional levels of physical fitness, coordination, and endurance, particularly in roles such as batting, bowling, and fielding. Despite its cultural and recreational prominence worldwide, the sport imposes considerable physical stress on players, making them highly susceptible to musculoskeletal injuries, especially in the lower extremities (1). Domestic-level cricketers are particularly at risk, as the rigorous nature of training and competition frequently leads to muscle fatigue, cramps, and strain-related injuries (2). Among these, lower limb muscle cramps remain one of the most common and performance-impairing conditions, often triggered by dehydration, electrolyte imbalances, or prolonged muscle exertion (3). These cramps predominantly affect major muscle groups such as the quadriceps, hamstrings, and triceps surae, thereby disrupting crucial biomechanical functions needed for sustained performance (4). The dynamic nature of cricket—characterized by repeated sprints, directional changes, and explosive movements—increases the likelihood of such muscular disturbances, which can lead to both immediate discomfort and long-term impairments (5). Notably, these cramps compromise a player's ability to maintain both static and dynamic stability, essential components for executing movements like delivering a ball, fielding, or running between wickets with precision (6).

Static stability refers to maintaining equilibrium during stationary phases, such as a batter's stance or a bowler's preparatory posture, while dynamic stability encompasses balance during motion, such as sprinting or fielding dives (7). When lower limb cramps occur, they undermine the neuromuscular coordination and proprioceptive control required for these balance mechanisms, consequently elevating the risk of further injuries and diminishing athletic performance (8). Muscle strength, joint flexibility, and motor coordination are foundational to maintaining such balance; any cramp-induced disruption in these elements can lead to altered postural control and reduced functional capacity (9). Empirical research has begun to explore this relationship in athletic populations. A study reported significant improvements in static balance following functional balance training combined with hip abductor muscle strengthening in cricketers (10). Similarly, a study found that cricket bowlers, due to the repetitive high impact demands of their role, exhibited impairments in both static and dynamic balance, likely stemming from sustained muscle tension and cramp episodes (11). Moreover, a study highlighted the significant link between dynamic balance and quadriceps muscle function, suggesting that individuals experiencing frequent lower limb cramps may face a higher risk of compromised postural control (12).

Despite these findings, a noticeable gap remains in literature specifically addressing how lower limb muscle cramps influence both types of balance among cricketers, especially in domestic-level players who lack access to professional recovery and conditioning protocols. Understanding this relationship is essential, not only for optimizing performance but also for preventing long-term musculoskeletal injuries that can prematurely end sporting careers. Hence, the objective of this study is to investigate the impact of lower limb muscle cramps on both static and dynamic balance in domestic cricketers, with the aim of informing targeted training and rehabilitation strategies to enhance performance and injury prevention.

## METHODS

This cross-sectional study was conducted at the University of Lahore, Lahore, to assess the impact of lower limb muscle cramps on static and dynamic balance among domestic male cricketers. Ethical approval for the study was obtained from the Institutional Review Board of the University of Lahore, and all participants provided informed written consent prior to participation. A total of 169 male cricketers aged between 18 and 35 years were recruited through non-probability convenience sampling. The sample size was determined using the Raosoft sample size calculator, referencing prior studies for estimation accuracy (5). Participants were included if they had at least three years of active cricket experience, played for a minimum of five hours daily, and had participated in three consecutive matches (13). Individuals with a history of recent trauma, diagnosed with medical conditions such as hypertension, diabetes mellitus, or neurological disorders, or those who had recently used performance-enhancing substances were excluded from the study (14). Data collection involved the administration of validated tools to assess muscle cramps, static balance, and dynamic balance. The Muscle Cramp Questionnaire, a reliable instrument with a Cronbach’s alpha of 0.82, was used to measure the frequency, severity, and possible triggers of lower limb cramps. Frequency was scored on a 0–4 scale (never to very often), and pain severity was rated from 0 to 10 (no

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pain to extreme pain) (15). Static balance was assessed using the Stork Balance Test, wherein participants stood barefoot on their dominant leg while the other foot rested against the inside knee of the stance leg, with hands on hips. Balance time was recorded in seconds until posture was lost. This test demonstrated strong construct validity (r = 0.78) and high test-retest reliability (ICC = 0.89) (16).

Dynamic balance was evaluated using the Star Excursion Balance Test (SEBT), a widely accepted and validated tool with excellent interrater and test-retest reliability (ICC > 0.90). Participants were instructed to reach maximally along eight directions from a central stance point without compromising their balance. Reach distances were measured in centimeters and averaged over three trials to ensure accuracy (15,16). Data were entered and analyzed using IBM SPSS Statistics version 27.0. Quantitative variables were summarized using means, standard deviations, and ranges, and visualized with histograms. Categorical variables were presented as frequencies and percentages, with graphical representations including bar and pie charts. Associations between categorical variables were assessed using the Chi-square test. Although the text mentioned data collection via the Visual Analogue Scale, Trendelenburg test, and hip prone extension test, these were not integrated into the description of the main outcome measures (muscle cramps, static and dynamic balance), creating a methodological inconsistency. Unless these tools were used for additional assessments or exploratory data, their inclusion appears misplaced and should be clarified or omitted in a final version to ensure methodological coherence.

## RESULTS

The descriptive analysis revealed that the mean age of participants was 21.22 ± 3.15 years, ranging from 18 to 30 years. The average height was recorded as 5.55 ± 0.41 meters, with a minimum of 4.11 and a maximum of 6.20 meters. The mean weight was 65.96 ± 10.35 kg, ranging from 45.00 to 91.00 kg. The sample consisted of 130 males (76.9%) and 39 females (23.1%). Regarding leg dominance, 110 participants (65.1%) demonstrated right-leg dominance, while 59 participants (34.9%) were left-leg dominant. In relation to muscle cramp frequency, 77 individuals (45.6%) experienced cramps on a daily basis, 61 (36.1%) reported weekly cramps, 21 (12.4%) had cramps monthly, and 10 (5.9%) experienced them less frequently. Regarding the location of muscle cramps, 88 participants (52.1%) reported cramping in the thigh, 64 (37.9%) in the calf, and 17 (10.1%) in the foot. Timing of occurrence showed that 68 participants (40.2%) experienced cramps at night, 55 (32.5%) both day and night, and 46 (27.2%) during the day. The majority, 110 participants (65.1%), reported that cramps lasted longer than one hour, while 33 (19.5%) experienced cramps lasting 30 to 60 minutes and only 6 (3.6%) for 1–5 minutes. Severity levels revealed that 114 participants (67.5%) experienced moderate cramps, 51 (30.2%) severe cramps, and 4 (2.4%) mild cramps.

A chi-square test showed a statistically significant association between dynamic balance, as assessed by the Star Excursion Balance Test, and muscle cramp severity for both dominant (P < 0.001) and non-dominant legs (P = 0.007). Participants with severe cramps had a higher proportion of poor dynamic balance scores, while those with mild or moderate cramps showed relatively better dynamic balance performance. Similarly, static balance evaluated by the Stork Balance Test was significantly associated with muscle cramp severity on the dominant leg (P < 0.001). Participants with severe cramps more frequently demonstrated poor or fair static balance. However, for the non-dominant leg, no statistically significant association was found between muscle cramp severity and static balance performance (P = 0.096), indicating a more localized effect of muscle cramps on the dominant limb's postural control. As cramp severity increased, a progressive decline in both dynamic and static balance scores was observed, particularly affecting performance on the dominant leg. This trend supports the notion that muscle cramps negatively influence lower limb stability and control, especially during physically demanding tasks requiring postural endurance and balance.

**Table 1: Chi square test of Star Excursion Balance Test Dominant Leg score * Total score MCQS**

| **Crosstab Star Excursion Balance Test Dominant Leg score * Total score MCQS** | | | | | | |
|---|---|---|---|---|---|---|
| | | Total score MCQS | | | Total | P value |
| | | Mild Cramps | Moderate Cramps | Severe Cramps | | |
| Star Excursion Balance Test Dominant Leg score | excellent | 2 | 14 | 8 | 24 | .000 |
| | average | 0 | 78 | 16 | 94 | |
| | poor | 2 | 22 | 27 | 51 | |
| Total | | 4 | 114 | 51 | 169 | |

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| **Crosstab Star Excursion Balance Test Dominant Leg score * Total score MCQS** | | | | | | |
|---|---|---|---|---|---|---|
| Crosstab Star Excursion Balance Test Non-Dominant Leg score *Total score MCQS | | | | | | |
| | | Total score MCQS | | | Total | P value |
| | | Mild Cramps | Moderate Cramps | Severe Cramps | | |
| Star Excursion Balance Test Non-Dominant Leg score | excellent | 1 | 32 | 8 | 41 | .007 |
| | average | 3 | 60 | 20 | 83 | |
| | poor | 0 | 22 | 23 | 45 | |
| Total | | 4 | 114 | 51 | 169 | |

**Table 2: Chi square test of Stork Balance Test Dominant Leg score * Total score MCQS**

| **Crosstab Stork Test Dominant score * Total score Muscle cramp** | | | | | | |
|---|---|---|---|---|---|---|
| | | Total score MCQS | | | Total | P value |
| | | Mild Cramps | Moderate Cramps | Severe Cramps | | |
| Stork Test Dominant score | excellent | 2 | 7 | 10 | 19 | .000 |
| | Good | 0 | 25 | 3 | 28 | |
| | Average | 1 | 27 | 12 | 40 | |
| | Fair | 1 | 45 | 3 | 49 | |
| | poor | 0 | 10 | 23 | 33 | |
| Total | | 4 | 114 | 51 | 169 | |
| Crosstab Stork Test Dominant score * Total score Muscle cramp questionnaire | | | | | | |
| | | Total score MCQS | | | Total | P value |
| | | Mild Cramps | Moderate Cramps | Severe Cramps | | |
| Stork Test Non-Dominant score | excellent | 2 | 22 | 12 | 36 | .096 |
| | Good | 0 | 22 | 6 | 28 | |
| | Average | 0 | 16 | 3 | 19 | |
| | Fair | 1 | 44 | 3 | 48 | |
| | poor | 1 | 10 | 27 | 38 | |
| Total | | 4 | 114 | 51 | 169 | |

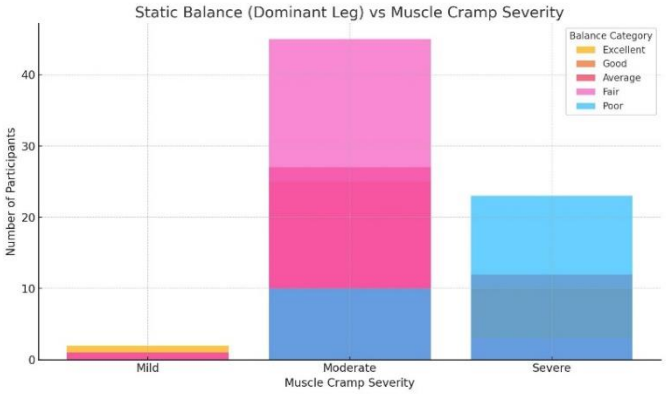



*Figure 1 Static Balance (Dominant Leg) vs Muscle Cramp Severity*

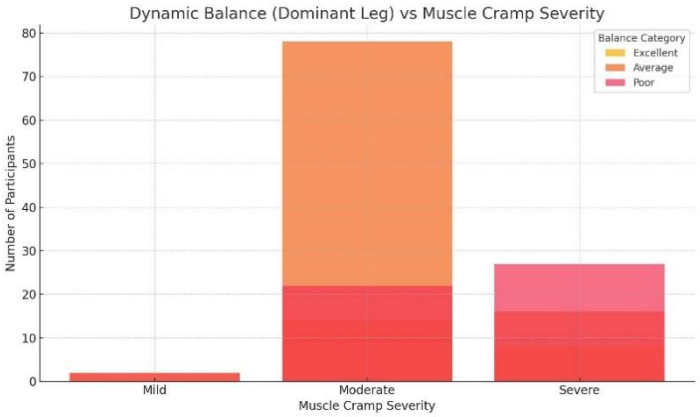



*Figure 2 Dynamic Balance (Dominant Leg) vs Muscle Cramp Severity*

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## DISCUSSION

The findings of this study highlighted a significant relationship between lower limb muscle cramps and impaired static and dynamic balance in domestic cricketers, reinforcing the growing body of evidence that supports the critical role of neuromuscular function in athletic performance. The results aligned with earlier research that demonstrated how targeted functional balance training, particularly when integrated with lower limb muscle strengthening, contributes to improved postural control and injury prevention among athletes (13,14). A high prevalence of muscle cramps was observed, with 65.1% of the participants reporting episodes predominantly affecting the thigh and calf regions. This widespread occurrence not only underscores the physiological burden placed on athletes during high-intensity training and competition but also illustrates a significant threat to performance stability. The correlation between the severity of muscle cramps and reduced balance scores, particularly on the dominant leg, provides strong evidence of the disruptive impact that cramp-induced neuromuscular fatigue can exert on an athlete's ability to maintain equilibrium (15,16). This association was further validated by balance test scores, which showed a progressive decline in postural control with increasing cramp severity. These results are particularly relevant given the physical demands of cricket, where players must perform explosive and coordinated movements, often on uneven or dynamic surfaces. Daily or frequent cramping, reported by a substantial proportion of participants, could hinder training regimens, delay recovery, and increase the likelihood of compensatory movement patterns that may predispose athletes to musculoskeletal injuries (17,18).

These findings supported previous literature suggesting that muscle cramps contribute to postural instability and highlighted the necessity for implementing preventative training strategies focused on balance, strength, and flexibility. Programs targeting both the dominant and non-dominant limbs appear essential, given that impairments were observed bilaterally, albeit more pronounced on the dominant side. This bilateral vulnerability suggests that neuromuscular imbalances may be systemic rather than isolated, requiring a comprehensive approach in both assessment and intervention. Another notable observation from this study was the lack of a strong correlation between static and dynamic balance tests. This suggests that these assessments capture different components of neuromotor control and cannot be used interchangeably. Static balance tests reflect postural control in stationary tasks, whereas dynamic balance measures movement-based equilibrium—each governed by distinct neuromuscular and proprioceptive mechanisms. The weak correlation underscores the importance of incorporating both types of assessments when evaluating balance impairments in cricketers affected by muscle cramps. These insights align with previous research that differentiated the predictive capacities of static and dynamic balance assessments in athletic populations (19,20).

From a demographic perspective, the study cohort primarily comprised young athletes aged 18 to 24 years with three to five years of competitive experience, which is consistent with earlier research on similar populations. The prevalence of muscle cramps in this group highlights the importance of early identification and tailored intervention in the developmental stages of an athlete's career. Despite these strengths, the study was limited by its cross-sectional design and homogenous sample, which restricts generalizability. The absence of longitudinal follow-up prevents evaluation of the long-term effects of muscle cramps on balance and performance. Moreover, external factors such as hydration status, fatigue levels, and environmental conditions, which are known contributors to cramping, were not controlled or assessed. These represent important variables that should be included in future studies to enhance analytical depth and ecological validity. Another limitation involved the reliance on self-reported cramp frequency and severity, which introduces the possibility of recall bias. Additionally, while validated tools were used to assess muscle cramps and balance, the study did not explore potential mediating variables such as muscular endurance, proprioceptive acuity, or joint mobility. The lack of regression analysis or predictive modeling also limited the ability to quantify the strength of associations and identify key predictors. Despite these limitations, the study contributes meaningful insights to the field of sports rehabilitation by reinforcing the link between muscle cramps and balance impairment. It provides a rationale for designing sport-specific prevention programs that incorporate neuromuscular conditioning, especially for athletes vulnerable to cramp-induced instability. Future research should include more diverse athletic populations, account for potential confounders, and explore longitudinal interventions that assess the effectiveness of targeted neuromuscular training over time. Such efforts would be critical in reducing injury risks and optimizing performance among athletes in physically demanding sports like cricket.

## CONCLUSION

This study concluded that lower limb muscle cramps are a prevalent concern among domestic cricketers, with moderate severity being the most commonly reported. The findings demonstrated a clear association between the severity of muscle cramps and impairments in

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both static and dynamic balance, indicating that these neuromuscular disturbances significantly affect postural control and athletic performance. These insights emphasize the importance of early identification and targeted intervention strategies, such as balance and strength training, to mitigate the impact of cramps and enhance overall stability, ultimately supporting injury prevention and improving on-field performance in cricketers.

**AUTHOR CONTRIBUTION**

| **Author** | **Contribution** |
|---|---|
| Noor Fazal | Substantial Contribution to study design, analysis, acquisition of Data<br>Manuscript Writing<br>Has given Final Approval of the version to be published |
| Maryam Abdul Qadir | Substantial Contribution to study design, acquisition and interpretation of Data<br>Critical Review and Manuscript Writing<br>Has given Final Approval of the version to be published |
| Wardah Ali | Substantial Contribution to acquisition and interpretation of Data<br>Has given Final Approval of the version to be published |
| Shah Subhan Rafay | Contributed to Data Collection and Analysis<br>Has given Final Approval of the version to be published |
| Eisha Imran | Contributed to Data Collection and Analysis<br>Has given Final Approval of the version to be published |
| Adnan Hashim* | Substantial Contribution to study design and Data Analysis<br>Has given Final Approval of the version to be published |

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