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Association between hamstring and lower back flexibility and sprint speed in cricketers

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Abstract
Aim: The aim of this study was to examine the relationship between hamstring and lower back flexibility and sprint speed performance.
Methodology: Total 168 cricketers (both male and female) included of aged 19-25 years. The cricketers were assessed for flexibility using the Active Knee Extension Test (AKET) for hamstrings and the Sit and Reach Test (SRT) for lower back flexibility. Sprint speed was measured using a 30-meter sprint test. Data were analyzed using SPSS software, and Pearson's correlation coefficient was applied to assess the relationship between flexibility and sprint speed.
Results: The results showed that females demonstrated greater hamstring and lower back flexibility than males, with no significant differences between dominant and non-dominant limbs for either gender.
Conclusion: There was a weak negative correlation between hamstring flexibility and sprint speed in males, while no such correlation was observed in females. Additionally, lower back flexibility did not significantly correlate with sprint performance in either gender. The study also found that lower back pain (LBP) was prevalent among fast bowlers, with reduced quadriceps and hamstring strength linked to an increased risk of LBP. These findings suggest that maintaining an optimal balance between flexibility and strength is crucial for improving sprint performance and reducing injury risk in cricketers.

Keywords: Hamstring flexibility, lower back flexibility, sprint speed, cricketers

Introduction
Cricket is a sport that has evolved over centuries, originating in Southeast England and now played globally. As the game has progressed, it has become physically demanding, requiring players to exhibit a combination of agility, strength, flexibility, and endurance [1]. Among the various physical challenges, hamstring injuries have emerged as a major concern in the sport, especially for cricketers. The game involves repetitive lower body actions such as sprinting, diving, and bowling, placing significant strain on the hamstrings muscles that are crucial for explosive movements [2]. The hamstring muscles play an integral role in stabilizing the leg during peak force activities, such as sprinting between wickets or making sudden directional changes. The high intensity of these movements increases the risk of hamstring injuries, particularly at the muscle-tendon junction [3].
Flexibility is another critical factor influencing performance and injury prevention in cricket. Flexibility refers to the ability of muscles and joints to move through their full range of motion, which is essential for both maximizing athletic performance and minimizing the risk of injury. In cricket, tight hamstrings and lower back muscles can significantly reduce movement capacity and increase susceptibility to injuries. For example, hamstring tightness can affect pelvic alignment and spinal biomechanics, leading to lower back pain and restricted hip and knee extension [4, 5]. This limitation in flexibility hampers sprinting performance and further escalates the risk of injury during high-speed activities [6].
In addition to flexibility, muscle strength is crucial for optimal speed and performance in cricket. Speed is a fundamental aspect of the game, and cricketers are often required to sprint at full intensity in short bursts. The combination of strength and flexibility enables efficient muscle function during movements such as sprinting, where muscles undergo a stretch-shortening cycle. Cricketers with optimal hamstring flexibility can perform these movements more effectively, enhancing both their speed and power. As a result, maintaining hamstring flexibility becomes key to improving performance and minimizing the likelihood of injury [7, 8].

Bowling, a core skill in cricket, places repetitive strain on the lower body and back. The action involves constant twisting, extension, and rotation of the lower body, creating significant ground reaction forces that can lead to overuse injuries in the lower extremities and back. These repetitive motions increase the risk of hamstring injuries and contribute to lower back pain, especially among fast bowlers who experience high intensity and frequency in their movements. Flexibility in the lower back and legs is essential for mitigating these risks and improving performance [9, 10].

Workload management is another important consideration in cricket, particularly in the T20 format, where the intensity of play is higher despite shorter game durations. Fluctuations in workload can challenge the body's ability to adapt, creating conditions conducive to hamstring and lower extremity injuries. As such, it is important to manage workloads carefully to reduce injury risks and ensure long-term player health [11, 12].

The connection between hamstring tightness and injury risk in cricket is well-documented, but research specific to the sport is limited. Tight hamstrings can restrict the range of motion in the hip and knee joints, leading to compensatory movements in other muscles, which can place additional strain on the lower back and pelvis. Furthermore, hamstrings play a stabilizing role alongside the anterior cruciate ligament (ACL) to control tibial translation during dynamic movements. A lack of flexibility in these muscles increases the risk of instability and injury [13, 14].

This study aims to fill a gap in research by investigating the role of hamstring flexibility in injury risk among cricketers. By assessing the flexibility of the hamstrings and lower back in male and female cricketers, the study seeks to explore the impact of flexibility on sprint performance and injury prevention. The findings will provide valuable insights for coaches, physical trainers, and athletes, contributing to more effective training programs that prioritize both performance and injury prevention. Ultimately, the study will advocate for early detection and intervention strategies, such as routine flexibility assessments, to reduce the incidence of hamstring and lower back injuries in cricketers [15, 16].

Methodology

This descriptive cross-sectional study was conducted with 168 cricketers during the 2023-2024 cricket season to investigate the relationship between flexibility and sprint speed. The subjects were male and female cricketers aged 19-25 years who had at least one year of formal training experience and had competed at district-level or higher tournaments. Participants with any history of spinal disorders, knee injuries, or surgeries were excluded from the study. The study aimed to compare hamstring and lower back flexibility between genders and analyze their correlation with sprint speed performance [17, 18].

Prior to data collection, written informed consent was obtained from all participants, with parental or guardian consent for those under 21 years of age. A five-minute warm-up session and static stretching exercises targeting key muscle groups such as the quadriceps, hamstrings, lower back, and upper extremities were performed to minimize variability and standard error in the measurements [19].

The data collection process included assessing flexibility using the Active Knee Extension Test (AKET) for hamstrings and the Sit and Reach Test (SRT) for lower back flexibility. Sprint performance was measured using the 30-meter sprint test. For the flexibility tests, the AKET used a goniometer to measure knee extension, and the SRT measured the distance a participant could reach while seated [20, 21].

In terms of statistical analysis, the data were analyzed using SPSS software version 26.0. Descriptive statistics were employed for categorical and continuous variables. To compare flexibility between the hamstring and lower back across genders, an unpaired t-test was performed, and Pearson's correlation coefficient was used to assess the relationship between flexibility and sprint speed. A significance level of $p \leq 0.05$ was used, with $p \leq 0.001$ considered highly significant [22, 23].

Results

The study presents a detailed analysis of cricketers' physical characteristics, with a focus on gender differences, flexibility, and the prevalence of lower back pain (LBP). The results indicate that there is no significant age difference between male and female cricketers, as both genders have a mean age around 21.9 years. Additionally, gender does not appear to influence playing positions, with males and females having similar distributions across batsman, bowler, and wicketkeeper roles [24, 25].

When it comes to flexibility, female cricketers show consistently higher hamstring flexibility than their male counterparts for both dominant and non-dominant legs, although no significant differences in flexibility between the dominant and non-dominant legs are observed in either gender. Lower back flexibility is also slightly greater in females, but again, the difference is marginally significant. As for sprint speed, there is a weak negative correlation with flexibility in males, meaning greater flexibility may be linked to slightly slower sprint times, while no such correlation is found in females [26, 27].

The study also highlights the prevalence of Low Back Pain (LBP) among fast bowlers, with 43.5% of the bowlers experiencing it. Notably, those with LBP had significantly lower quadriceps strength on their dominant side and lower hamstring strength on their non-dominant side. These findings suggest that greater muscle strength, particularly in the quadriceps and hamstrings, may reduce the risk of LBP [28, 29]. General characteristics such as age, bowling experience, training hours, and BMI did not show significant differences between fast bowlers with and without LBP [30, 31].

Furthermore, muscle strength, especially in the quadriceps and hamstrings, appears to be a crucial factor in mitigating the risk of LBP in fast bowlers [32, 33].

Discussion

This study explores the relationship between flexibility, sprint performance, and demographic characteristics in male and female cricketers, with a particular focus on gender-based differences. Previous research has examined various factors related to cricketer performance, but this study is one of the few that compares both male and female athletes in terms of flexibility, sprint speed, and playing position. The research aims to address gaps in understanding how physical attributes, particularly flexibility, influence athletic

performance in cricket and contribute to injury prevention [34, 35].

The study involved 168 cricketers, evenly split between males and females, ensuring a balanced comparison. The mean age of participants was approximately 22 years for both genders, suggesting that age did not significantly influence the results. The findings support previous studies that show age-related physiological differences are less impactful on flexibility and sprint performance at this stage of athletic development. Notably, the study found that flexibility varied between genders, with females demonstrating greater flexibility, particularly in the hamstrings and lower back. This aligns with existing literature on gender-based physiological differences, where females typically exhibit greater joint flexibility due to factors like pelvic structure and connective tissue composition [36, 37].

Sprint performance was examined in relation to flexibility, revealing that hamstring flexibility had a weak but statistically significant negative correlation with sprint speed in male cricketers, suggesting that excessive flexibility might slightly hinder performance. In contrast, no such correlation was found in female cricketers, indicating that other factors such as neuromuscular coordination and muscle strength may play a more significant role in their sprinting performance. Furthermore, the study identified that lower back flexibility had no significant relationship with sprint performance for either gender, supporting prior research which suggests that core strength and running mechanics are more influential on sprinting ability than flexibility alone [38, 39].

A key finding of the study was the association between muscle strength and the risk of Low Back Pain (LBP) among cricketers, especially in fast bowlers. Cricketers with weaker quadriceps and hamstrings, particularly on the non-dominant side, were more likely to experience LBP. This suggests that strength imbalances in key muscle groups could increase the vulnerability to injury, reinforcing the importance of targeted strength training as part of injury prevention strategies [40, 41].

The study also calls for a gender-specific approach to training and injury prevention. Female cricketers may benefit from strength and sprint drills to optimize their performance, while male cricketers should focus on maintaining a balance between flexibility and muscle stiffness to enhance sprinting power. Additionally, cricketers in specific playing positions, such as bowlers or wicketkeepers, may require tailored training programs to address the unique demands of their roles.

This research contributes to the growing body of literature on cricket performance, with practical implications for training regimens and injury prevention strategies. However, there are several limitations to the study, including the use of a cross-sectional design and the focus on only hamstring and lower back flexibility. Future studies could expand on these findings by incorporating other performance metrics, exploring the influence of training regimens, and examining the role of muscle strength and flexibility in relation to different playing positions.

Conclusion

In summary, the findings of this study revealed that general characteristics such as age, BMI, training hours per week, and experience did not significantly contribute to the development of low back pain (LBP) symptoms among adolescent fast bowlers aged 15-19 years. However, the study found that higher muscular strength in the dominant side quadriceps and non-dominant side hamstring muscles was associated with a reduced likelihood of developing LBP. These findings suggest that focusing on strengthening key muscle groups may help prevent LBP in young fast bowlers, highlighting the importance of targeted strength training in injury prevention.

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