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FMS SCORES AND INJURY RISK: A CROSS-SECTIONAL STUDY OF DOMESTIC CRICKET PLAYERS IN KARACHI

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ABSTRACT

This study aimed to assess the association between Functional Movement Screening (FMS) scores and injury incidence among domestic cricket players in Karachi. A total of 150 male players aged 18-35 years were included, each of whom underwent FMS testing and provided details on their injury history. FMS scores were used to identify movement deficiencies, with scores ≤14 indicating potential injury risk. The study employed a cross-sectional design, and data were analyzed using descriptive statistics, chi-square tests, and logistic regression analysis to explore the relationship between FMS components and injury history. Results revealed that 50% of the players reported having a history of injuries. The Low FMS Score (≤14) group showed a higher proportion of players with injury histories (53.3%) compared to the High FMS Score (>14) group (46.7%). Logistic regression analysis identified key FMS components as significant predictors of injury risk. Deep Squat, Shoulder Mobility, and Trunk Stability Push-up were found to significantly increase the likelihood of injury, with odds ratios of 1.5, 1.6, and 1.4, respectively. Conversely, components such as Inline Lunge and Rotary Stability did not show a significant relationship with injury risk.

This study highlights the potential of FMS as a tool for identifying players at risk of injury in cricket. Targeted interventions to improve movement patterns in areas like Deep Squat and Shoulder Mobility could reduce injury incidence and enhance overall player performance. Future research should investigate the long-term effects of FMS-based interventions in cricket and other sports to further validate these findings.

Keywords: *Functional Movement Screening, Injury Incidence, Cricket Players, Movement Deficiencies, Injury Prediction, Injury Prevention, Sports Screening.*

INTRODUCTION

Cricket is one of the most widely played sports in South Asia, with Karachi being a hub for nurturing domestic talent. Cricket requires a unique blend of physical attributes, including strength, agility, endurance, and flexibility, which can vary significantly between players depending on their role as batsmen, bowlers, or all-rounders (Patel et al., 2024). Despite its global popularity, cricket is associated with a high prevalence of injuries, ranging from acute traumatic injuries to chronic overuse conditions (Baa et al., 2021). Bowlers, in particular, are at a heightened risk of musculoskeletal injuries due to the repetitive and high-impact nature of their movements. Early identification of injury risks in cricketers is crucial for designing effective preventive and rehabilitative strategies (Faisal, 2023).

Functional Movement Screening (FMS) is a tool widely utilized to assess fundamental movement patterns, asymmetries, and limitations that may predispose athletes to injuries. FMS evaluates seven basic movement tasks—deep squat, hurdle step, in-line lunge, shoulder mobility, active straight-leg raise, trunk stability push-up, and rotary stability—assigning scores based on movement quality (Singh et al., 2023). Higher FMS scores are generally associated with better movement efficiency and lower injury risks. While FMS has gained traction globally as an effective screening tool in various sports, its application and relevance to cricket, especially within the context of domestic players in Karachi, remain underexplored (Orer et al., 2023).

Despite the growing body of evidence supporting FMS as a predictive tool for injury risk, most existing studies have focused on elite athletes in sports such as football, basketball, and rugby (Erikoglu et al., 2023). There is a notable scarcity of research targeting cricket players, particularly those at the domestic level, who may not have access to the same resources as their professional counterparts (Morgan et al., 2024). Moreover, no comprehensive study has been conducted to evaluate the association between FMS scores and injury incidence among domestic cricket players in Karachi (Minhas et al., 2024). Considering the unique physical demands and injury profiles in cricket, investigating the utility of FMS in this population is both timely and necessary. Domestic cricket players in Karachi often experience injuries that compromise their performance and may even limit their career progression. The absence of standardized screening protocols for early identification of injury risks exacerbates this issue. Without evidence-based tools like FMS, coaches and physical therapists may lack the necessary insights to design targeted injury prevention programs (Raza et al., 2021). This gap in preventive strategies highlights the need for localized research to assess the applicability and predictive validity of FMS in this specific demographic.

This study is significant for several reasons. First, it aims to fill the existing research gap by providing empirical evidence on the relationship between FMS scores and injury risks in domestic cricket players in Karachi. Second, the findings have the potential to inform the development of targeted injury prevention programs tailored to the specific needs of cricketers. Third, this research can contribute to reducing injury prevalence, enhancing player performance, and ensuring the longevity of cricket careers at the domestic level. Lastly, by establishing a baseline for movement quality and injury incidence, this study can serve as a reference point for future investigations in similar settings.

Objectives

The primary objective of this study is to evaluate the association between FMS scores and injury incidence among domestic cricket players in Karachi. Specifically, the study seeks to:

1. Assess the prevalence of injuries among domestic cricket players in Karachi.
2. Analyse the relationship between individual FMS components and specific types of injuries.
3. Identify movement patterns or deficits that are most predictive of injury risks in cricket players.
4. Provide recommendations for integrating FMS into routine screening and training practices for cricket teams in Karachi.

By addressing these objectives, this study aims to provide actionable insights that can improve the overall health and performance of domestic cricket players in Karachi.

Literature Review

Functional Movement Screening (FMS) was first developed as a systematic tool to evaluate movement patterns, identify dysfunctions, and predict injury risk (Ozyurt et al., 2024). The premise of FMS is that poor movement patterns, often caused by muscular imbalances, joint restrictions, or motor control deficits, increase the likelihood of injury. The FMS test battery includes seven fundamental movements, each scored from 0 to 3, with a composite score out of 21 (Xiao et al., 2021). Lower scores are associated with a greater likelihood of injury, prompting its adoption as a preventive tool across various sports disciplines.

Numerous studies have validated the predictive ability of FMS in team sports like soccer, basketball, and rugby. For example, Senjam et al. (2021) demonstrated that athletes with FMS scores below 14 were significantly more likely to sustain injuries. Similarly, Martin et al. (2021) found a strong correlation between FMS scores and lower extremity injuries in collegiate athletes. Despite these findings, the application of FMS in cricket remains limited, particularly in domestic settings where access to advanced screening tools is restricted (Liu et al., 2023).

Cricket is a sport characterized by diverse physical demands, with injury patterns varying by player role. Bowlers, who perform repetitive high-speed actions, are prone to lumbar stress fractures, shoulder injuries, and hamstring strains (Asgari et al., 2021). Batsmen, on the other hand, face risks of hand and wrist injuries due to frequent impact with the ball. Fielders are susceptible to acute injuries such as sprains and muscle strains, particularly during dives or high-speed sprints. Overuse injuries are also common in cricket due to prolonged training sessions and matches (Clark et al., 2022).

Studies on cricket injuries have primarily focused on elite or international players, often overlooking domestic athletes who face similar risks but lack adequate medical support (Callanhan et al., 2024). Furthermore, the biomechanical demands of cricket, such as rotational forces during bowling and batting, necessitate a sport-specific approach to injury prevention. By incorporating FMS into cricket, it is possible to address movement inefficiencies and reduce the risk of these injuries (Keil et al., 2021).

FMS has been widely used to assess injury risks in athletes, with several studies highlighting its effectiveness. For instance, a study by O'Brien et al. (2022) found that FMS scores were significantly correlated with lower extremity injuries in young athletes. Another study by Harper et al. (2021) showed that incorporating FMS into training programs reduced injury rates by addressing movement dysfunctions identified during screening.

In cricket, however, the use of FMS remains sparse. A pilot study by Cornell et al. (2021) explored the relationship between FMS scores and injuries in semi-professional cricketers, finding that low scores were associated with a higher prevalence of injuries. Despite these promising results, larger studies are needed to validate these findings and establish normative FMS scores for cricket players (Niles et al., 2021).

Cricket involves complex, multi-joint movements that place significant stress on the musculoskeletal system (Karuc et al., 2021). Bowling, for example, generates high rotational forces through the spine and shoulders, while batting requires dynamic balance, core stability, and hand-eye coordination. These biomechanical demands highlight the relevance of FMS in cricket, as the screening tool assesses fundamental movement patterns critical to these actions (Moore et al., 2023).

The deep squat and in-line lunge, for instance, evaluate lower body strength and stability, which are essential for bowlers. Similarly, the rotary stability and shoulder mobility tests address core control and upper body flexibility, key attributes for both batting and fielding (Macmillan et al., 2023). By identifying deficits in these areas, FMS can guide targeted interventions to improve performance and reduce injury risks.

Despite its potential benefits, implementing FMS in domestic cricket faces several challenges. Limited access to trained professionals and equipment may hinder widespread adoption. Additionally, the lack of sport-specific modifications to FMS protocols may reduce its applicability in cricket (Kodikara et al., 2022). Addressing these challenges requires collaboration between researchers, coaches, and physical therapists to adapt FMS for cricket and promote its integration into training routines. Recent advancements in wearable technology and motion analysis systems have opened new avenues for enhancing FMS assessments (An et al., 2021). Integrating these technologies with traditional FMS protocols could provide real-time insights into movement patterns, enabling more precise identification of dysfunctions. Additionally, the development of

cricket-specific FMS adaptations—considering the unique demands of bowling, batting, and fielding—would increase the tool's relevance and accuracy for this population (Minhas et al., 2024). Future research should also explore the long-term impact of FMS-guided interventions on injury prevention and performance enhancement in cricket.

Furthermore, community-level awareness campaigns and workshops for coaches and trainers could promote the adoption of FMS in domestic cricket (Mehmood et al., 2024). By emphasizing the cost-effectiveness and preventive potential of FMS, stakeholders can ensure its integration into training programs, fostering a proactive approach to injury management (Bashir et al., 2022).

Methodology

Study Design

This study employed a cross-sectional design to evaluate the association between FMS scores and injury incidence among domestic cricket players in Karachi. The design was deemed appropriate as it allowed for the simultaneous assessment of FMS performance and the documentation of injury histories within a defined population.

Participants

The study recruited 150 domestic cricket players from various clubs and academies in Karachi. Participants were male, aged 18-35 years, and actively engaged in training or competitions for at least one year. Players with existing injuries that prevented participation in FMS tests were excluded.

Data Collection

1. **Demographic and Injury History:** Players completed a standardized questionnaire that gathered information on age, playing role, training hours, and injury history (type, location, and recurrence).
2. **Functional Movement Screening:** Certified professionals conducted FMS tests for all participants. Each movement was scored on a scale of 0-3, and a composite score out of 21 was calculated for each player. Low scores (≤14) were flagged for potential movement inefficiencies.

Data Analysis

The collected data were analysed using statistical software SPSS Version 27. Descriptive statistics summarized the demographic and injury-related characteristics of the participants. Chi-square tests were conducted to examine the association between low FMS scores and injury incidence. Logistic regression analysis identified specific FMS components that significantly predicted injury risks. The significance level was set at $p < 0.05$.

Ethical Considerations

The study adhered to ethical guidelines for research involving human participants. Approval was obtained from the relevant institutional ethics committee. Written informed consent was secured from all participants prior to data collection, ensuring they were fully aware of the study's purpose, procedures, and potential risks. Confidentiality of participant data was maintained throughout the research process, and participants were assured of their right to withdraw from the study at any time without repercussions.

Results

Demographics

Description	Frequency (%)
Age (years)	24.5
Training Hours/Week	12.4
Batsman (%)	33.3
Bowler (%)	40
All-rounder (%)	26.7
Injury History (%) Yes	50

Injury History (%) No	50
FMS Composite Score Mean	15.8

Table 1: Demographics

The demographic and injury-related characteristics of the 150 domestic cricket players included in this study are summarized in the table. The average age of the participants was 24.5 years, indicating that the players were predominantly young and in their peak athletic years. On average, players trained for 12.4 hours per week, reflecting a moderate level of commitment to training. In terms of playing roles, 33.3% of the players were batsmen, 40.0% were bowlers, and 26.7% were all-rounders. These proportions suggest a diverse distribution of roles, with bowlers representing the largest group. Regarding injury history, 50% of the players reported having a previous injury, while the remaining 50% had no injury history, underscoring the importance of assessing injury risk factors within this cohort. The average Functional Movement Screening (FMS) composite score was 15.8, indicating a generally good level of functional movement among the players, though some participants may still exhibit movement deficiencies, particularly those with a score of 14 or below, which is commonly associated with an increased risk of injury. These characteristics form the foundation for further analysis on the association between FMS scores and injury incidence.

Type of Injuries

Injury Type	n (%)
Strain	20
Sprain	13.3
Fracture	6.7
Dislocation	3.3
Contusion	6.7
No Injury	50

Table 2: Type of Injuries

The distribution of injury types among the 150 domestic cricket players in the study is presented in the table. The most common injury reported was strain, affecting 20% of the players, followed by sprain at 13.3%. Fractures were reported by 6.7% of the players, while dislocations were the least frequent, accounting for only 3.3%. Contusions were also reported by 6.7% of the players. Notably, 50% of the participants reported having no injury history, highlighting that half of the players had not experienced any injuries during their careers. This distribution of injury types helps contextualize the injury patterns observed in the study and provides insight into the potential factors influencing injury risk in cricket players.

Chi Square

FMS Score Group	Injury History: Yes (%)	Injury History: No (%)	Total
Low FMS Score (≤14)	53.3	46.7	75
High FMS Score (>14)	46.7	53.3	75

Table 3: Chi Square

The table presents the results of a chi-square analysis examining the association between FMS score groups (low vs. high) and injury history (yes vs. no) among the 150 domestic cricket players.

The data is divided into two groups based on their FMS composite scores:

- Low FMS Score (≤14): This group includes players with composite scores of 14 or lower, which are typically flagged for potential movement inefficiencies and an increased risk of injury. Within this group, 53.3% of the players reported having an injury history, while 46.7% had no injury history.
- High FMS Score (>14): This group includes players with composite scores above 14, indicating better functional movement. Among these players, 46.7% reported having an injury history, while 53.3% had no injury history.

The table shows an equal distribution of players in both the "Low FMS Score" and "High FMS Score" categories, with 75 players in each group, making a total of 150 participants.

This table suggests a potential link between FMS scores and injury history. While the percentage of players with injuries is higher in the Low FMS Score group (53.3%) compared to the High FMS Score group (46.7%), the data also shows that Injury History: No is more common in the High FMS Score group (53.3%) than in the Low FMS Score group (46.7%). This initial observation suggests that players with higher FMS scores may be less prone to injury. However, a chi-square test is needed to statistically determine if this difference is significant and whether low FMS scores are truly associated with an increased risk of injury.

Logistic Regression

FMS Component	Odds Ratio (OR)	95% CI	p-value
Deep Squat	1.5	1.10-2.05	0.02
Hurdle Step	1.3	1.00-1.70	0.045
Inline Lunge	1.1	0.85-1.40	0.45
Shoulder Mobility	1.6	1.20-2.10	0.01
Active Straight Leg Raise	1.2	0.90-1.60	0.2
Trunk Stability Push-up	1.4	1.10-1.80	0.03
Rotary Stability	1.1	0.85-1.40	0.38

Table 4: Logistic Regression

The logistic regression analysis examined the relationship between individual Functional Movement Screening (FMS) components and the likelihood of injury among the 150 cricket players. The results, presented as odds ratios (OR), show the likelihood that poor performance on a specific FMS test increases the risk of injury.

- Deep Squat showed a significant association with injury risk (OR = 1.5, p = 0.02). Players with poor performance on the Deep Squat test were 1.5 times more likely to report an injury, suggesting that issues with this movement pattern are an important predictor of injury risk.
- Hurdle Step also had a significant effect (OR = 1.3, p = 0.045). A poor Hurdle Step score increases the risk of injury by 30%, underlining the importance of this movement in injury prevention.
- Inline Lunge (OR = 1.1, p = 0.45) and Rotary Stability (OR = 1.1, p = 0.38) showed no significant relationship with injury risk, as their p-values were greater than 0.05. These components may not be as strongly linked to injury likelihood in this population.
- Shoulder Mobility demonstrated the highest odds ratio (OR = 1.6, p = 0.01), meaning that players with restricted shoulder mobility are 60% more likely to suffer from injuries. This highlights the critical role of shoulder flexibility in injury prevention.
- Active Straight Leg Raise (OR = 1.2, p = 0.2) did not show a significant relationship with injury risk, as its p-value exceeded the threshold for significance.
- Trunk Stability Push-up (OR = 1.4, p = 0.03) was found to significantly predict injury risk. A decrease in trunk stability was associated with a 40% higher likelihood of injury, emphasizing the importance of core strength in preventing injuries.

In conclusion, the analysis identifies several key FMS components, particularly Deep Squat, Hurdle Step, Shoulder Mobility, and Trunk Stability Push-up, as significant predictors of injury risk. Players with deficiencies in these areas are more likely to experience injuries, suggesting that targeted interventions to improve these specific movement patterns could reduce injury incidence in domestic cricket players.

Discussion

This study evaluated the association between Functional Movement Screening (FMS) scores and injury incidence among domestic cricket players in Karachi, offering valuable insights into injury prevention within the sport. When comparing our findings with existing research in other sports, several key patterns and

contrasts emerge, particularly in the relevance of specific FMS components and their correlation with injury risk.

Similar studies in sports such as basketball and soccer have also highlighted that low FMS scores correlate with higher injury rates. In a study by Ferrando et al. (2022), athletes with low FMS scores were found to have an increased risk of injury, especially in football players. Our findings mirror this, with a greater proportion of players in the low FMS score group (≤14) reporting a history of injuries. However, it's important to note that while the chi-square test did not show a statistically significant difference between FMS scores and injury incidence in our sample, the trend is consistent with the broader literature, which generally supports a relationship between poor functional movement and injury risk.

The logistic regression results from our study identify Deep Squat, Hurdle Step, Shoulder Mobility, and Trunk Stability Push-up as significant predictors of injury risk, a finding consistent with research in rugby and basketball where these components have also been linked to injury predisposition. Specifically, our findings align with Einstad et al. (2021), who found that shoulder mobility was a key predictor of shoulder injuries in overhead athletes, which is applicable to cricket bowlers who experience repetitive overhead motions. Additionally, Trunk Stability Push-up in our study was associated with an increased likelihood of injury, reinforcing the importance of core strength, a factor widely recognized in sports like athletics and swimming, where trunk stability plays a crucial role in injury prevention.

While Inline Lunge and Rotary Stability did not show significant associations with injury in our study, previous research has indicated mixed results for these components. For example, Sun et al. (2022) found that deficits in rotary stability could predict future injuries in certain sports, but this was not consistently observed across all populations, as seen in our study. It's possible that the cricket-specific context of the current study—where dynamic, unilateral movements like running and bowling dominate—makes certain FMS components, like Hurdle Step and Deep Squat, more predictive than others.

Finally, our study's comparative approach with research on other sports suggests that while FMS is a valuable tool for injury prediction, its relevance and the significance of individual components may vary depending on the sport, the level of competition, and the specific injury patterns of the athletes involved. For cricket, a sport characterized by varied movements (e.g., batting, bowling, fielding), a multifaceted approach to injury prevention, focusing on improving key movement patterns such as those identified in the Deep Squat and Shoulder Mobility tests, could help in reducing injury risk.

Conclusion

In conclusion, this study provides evidence supporting the use of Functional Movement Screening (FMS) as a tool to assess and predict injury risk among domestic cricket players in Karachi. The results highlight those players with deficiencies in specific FMS components, such as Deep Squat, Shoulder Mobility, and Trunk Stability Push-up, are more likely to sustain injuries. While other FMS components like the Inline Lunge and Rotary Stability did not show significant associations with injury, the findings suggest that addressing movement inefficiencies in critical areas could help reduce injury incidence in cricket players.

The study underscores the importance of incorporating FMS into routine injury screening and training practices. Future research should aim to replicate these findings in different sports populations and investigate the long-term effects of movement-based interventions on injury prevention. By improving functional movement, cricket teams may enhance player durability, optimize performance, and reduce the frequency of injuries, ultimately contributing to the overall development of the sport.

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