

Evaluation of lumbar core stability among club level cricket bowlers: A cross-sectional study

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Abstract

Objective: To evaluate the lumbar core stability in club-level cricket bowlers.

Method: This descriptive cross-sectional study was conducted in the twin cities of Rawalpindi and Islamabad in Pakistan from July 15 to December 10, 2022, after approval from the ethics review board Foundation University Medical College, Islamabad, and comprised male, club-level, hard-ball cricket bowlers aged 18-24 years. Data was collected through a self-structured demographic sheet, and core stability was assessed using McGill Torso Muscle Endurance Test Battery. Data was analysed using SPSS 21.

Results: There were 296 male subjects with a mean age of 20.1±1.77 years. Of them, 90(30.4%) bowlers had good lumbar flexion-to-extension ratio and 206(69.6%) had poor ratio. Lateral endurance test of right-to-left side-bridge ratio showed 71(24%) players in the good category, and 225(76%) in the poor category. The ratio of right lateral endurance to lumbar extensor was good in 55(18.6%) and poor in 241(81.4%) subjects. The ratio of left lateral endurance to lumbar extensor endurance was good in 40(13.5%) players and poor in 256(86.5%).

Conclusion: Lumbar core stability was found to be quite poor among club-level cricket bowlers of Rawalpindi and Islamabad.

Keywords: Athletes, Core stability, Cricket, Bowlers, Sport. (JPMA 74: 1449; 2024)

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Introduction

Physical education and sports industries have attained top-most priority over time across the world, both in developed and developing countries. Engaging in sports has both positive and negative effects on health. The positive impacts of playing regular sports are achieved mainly due to the increased physical activity and its subsequent benefits on physical and psychosocial health. On the other hand, it is also associated with some negative effects, such as eating disorders, burnout and especially a high risk of injury.¹

Among the many sports played globally, cricket is the world's second most popular sport, after football, which has involved people regardless of age, gender and socioeconomic background. It was initially more famous in the Commonwealth nations, but now is being played in almost 105 member countries of the International Cricket Council (ICC). Cricket is a bat-and-ball game that requires an optimum level of skill, strategy as well as physical fitness.

As far as injury rate is concerned, although it is not a

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contact sport, impact and overuse injuries are quite common because the players are involved in a broad range of activities, such as throwing, bowling, batting, catching, jumping, running and diving.^{2,3} With the rise of T-Twenty (T20) version of the game, the physical preparation of elite cricket players has become complex, with high match injury incidence.⁴ Majority of research related to cricket injuries has stemmed from the developed countries.⁵

Cricket players have their own individual roles, like batting or bowling at slow, medium or fast speeds, and they are trained for improved fitness, strength and conditioning in accordance with their distinct roles within a team.⁶ Among the group of fast bowlers, further classification is done to distinguish fast, medium-fast and fast-medium bowlers in accordance with the speed of delivery. The rate of ball delivery in elite-level fast bowlers is approximately 36-40.5m/s (129-145.8km/h).⁷ Bowlers with better trunk muscle stability bowled faster than those with a lower level of trunk stability, irrespective of their age, height and weight. Thus trunk muscle thickness and ball release speeds were found to be correlated.⁸

Fast bowlers are an integral component of the team as their success means team success, and, hence, researches are also directed towards them. But unfortunately, compared to their peers, they have the shortest career spans due to injuries, and multiple studies have been conducted to observe the biomechanical profile and target injury-

prevention in fast bowlers.^{6,9,10} Fast bowlers are more prone to injuries than any other player in their respective sport, and even in their short career, a significant on-field time is lost as they have to recover from multiple injuries.¹¹

The kinematic chain of fast bowler is an important concept to understand, as the force delivery mechanism is the arm, while force regulation is achieved by the shoulder, and force generation by the ground, legs and trunk. In order to achieve high ball-release speeds, the bowler's trunk must laterally flex, extend, flex and rotate within a very quick time, and the body must absorb ground reaction forces as high as six times of the body weight. As the throwing force generation from the shoulder is not sufficiently large, other segments of body are also involved to generate enough force for desired propulsion of the ball and for the transference of forces to distal body parts.¹²

Here comes the highly essential role of core stability. The kinematic chain theory describes core stability as the ability to control the position and motion of the trunk and pelvis relative to the extremities in order to allow for optimal force production, dissipation and transfer to the extremities during movement. Complex coordination of upper and lower limbs is required during bowling. The core functions as the central link between the upper and lower extremities, and stability of this region is required for highest athletic performance and injury prevention. In a weak core, the transfer of energy is altered that can cause reduced performance and risk of injury to a weak or underdeveloped muscle group.^{13,14} However, the efficacy of core stability cannot be determined by a single test. Specifically, separate assessments of the local and global muscular systems' contributions to core stability are required.¹⁵ A study observed that exercises focussing on balance and core stability were frequently linked to increased athletic performance and/or a lower risk of injury.¹⁶ For a very long time, the most popular core physical training activities were sit-ups and curl-ups.¹⁷ Thus, it appears that core muscle function affects lower extremity stiffness, and can function as a performance index in athletes.¹⁸

Studies have reported neuromuscular deficiencies and core muscle weakness as major factors of non-contact sports injuries in fast bowlers. Hence, focus should be directed towards this aspect of players' fitness during their training.¹¹ Effective rehabilitation programmes may reduce the risk of re-injury. Ideally, these programmes need to be role-specific.¹⁹ For instance, performing Federation Internationale de Football Association (FIFA 11+) training can help soccer players with coordination and agility by improving neuromuscular control.²⁰ Various studies have been done on cricketers in Pakistan, such as a study in

Lahore on the prevalence of musculoskeletal disorders among cricketers, which found that musculoskeletal injuries were quite prevalent among cricketers, with the highest frequency of lower back injuries, followed by sprains and strains to the shoulder and lower limbs.²¹ Another cross-sectional survey in Peshawar on the pattern of wrist and hand injuries amongst cricket players concluded that hand injuries were more common on the right side and were more frequent compared to wrist injuries. Besides, players were most often injured during fielding.²² To our knowledge, no study has been conducted on the assessment of core stability among club-level cricket bowlers in Pakistan. The current study was planned to fill the gap by evaluating core muscle stability among club-level cricket bowlers in a Pakistani setting.

Subjects and Methods

This descriptive, cross-sectional study was conducted in the twin cities of Rawalpindi and Islamabad, Pakistan, from July 15 to December 10, 2022. After approval from the ethical review board Foundation University Medical College, Islamabad, (FF/FUMC/215-182/Phy/22), the sample size was calculated using Raosoft online calculator, keeping margin of error 5%, confidence level 95%, population size 1296, and response distribution 50%.²³ The population size was obtained by gathering the information of registered cricket clubs in Rawalpindi/Islamabad, followed by contacting the club managers to record the total number of bowlers in each club, the sum of which came out to be 1296. Non-probability sampling technique was used for recruiting players from 13 clubs. Those included were male, club-level, hard-ball cricket bowlers aged 18-24 years who had a minimum of 6 months of playing experience at the club level, and trained for at least 4 days a week for a minimum of 2 hours per day. Those with any type of injury or recent surgery, suffering from low-back pain or those who played with tape ball were excluded.

Data was collected after taking informed consent from the subjects. The data gathered was accessible only to the primary investigating team. Demographic and anthropometric data was collected using a self-structured questionnaire. This was followed by the assessment of lumbar core stability using McGill's Torso Muscle Endurance Test Battery, which comprises trunk flexor, trunk extensor and trunk lateral endurance tests. The flexion test (abdominal fatigue test), extension test (back extensor test), and side-bridge tests have reliability coefficients ranging 0.97-0.99. Scoring was done by calculating the total duration of holding each isometric position, and a minute's rest was allowed between each test. For flexion-to-extension, the ratio should be <1. For right-side-to-left-side bridge, the score should be 0.5 ± 1.0

(0.95-1.05), and for right-side-bridge-to-extension ratio, and left-side-bridge-to-extension ratio, the score should be <0.75.²⁴ The trunk endurance tests were conducted in the field, and core assessment of the players was carried out after warm-up before their training session.

Data was analysed using SPSS 21. Quantitative variables were expressed as mean±standard deviation. Qualitative variables were expressed as frequencies and percentages. The results of lumbar core stability were expressed as descriptive statistics and reported in the form of averages and categories.

Results

Of the 296 male cricketers, 27(9.1%) were from the National and Bilal Cricket Club, 20(6.8%) from Bajwa Cricket Academy, 14(4.7%) from Sabih Azhar Cricket Academy (SACA), 10(3.4%) from Sabi cricket club, 7(2.4%) from Paramount Cricket Club, 24(8.1%) from 11 Star Cricket Academy, 61(20.6%) from Diamond Academy, 41(13.9%) from Galaxy Academy, 10(3.4%) from Kiwi Boys Cricket Club, 55(18.6%) from Islamabad Lions Cricket Academy, 10(3.4%) from Greenland Cricket Club, 11(3.7%) from Mughal Cricket Club, and 6(2.0%) were from Gymkhana Cricket Club. The overall mean age was 20.15±1.77 years, mean height was 175.07±5.62cm, mean weight was 66.35±7.68kg, and mean body mass index (BMI) was 21.47±2.41kg/m². The subjects bowled an average of 11.05±2.98 overs per day and around 77.52±20.94 overs per week.

Among the participants, 205(69.3%) had right bowling arm, and 91(30.7%) used the left arm for bowling. There were 180(60.8%) players with front-on bowling action and 116(39.2%) with side-on bowling action. Overall, 151(51%) bowlers had a high-arm delivery pattern, whereas 145(49%) had side-arm delivery pattern. There were 65(22%) bowlers with a jerky follow-through, 184(62.2%) had a smooth follow-through, and 47(15.9%) had a swinging follow-through. There were 116 (39.2%) players who had a run-up distance of 10-15 paces, 143(48.3%) with 15-20 paces, and 37(12.5%) had run-up distance of 20-25 paces. There were 94(31.8%) bowlers with a fast-run up speed, 158(53.4%) had medium, and 44(14.9%) had a slow run-up speed.

Mean trunk flexor endurance time was 110.51±54.55 seconds, mean trunk extensor endurance time was 84.72±33.15 seconds. For the right lateral extensors, it was 88.29±32.78 seconds, and it was 88.54±34.17 seconds for the left lateral extensors (Table 1).

Mean flexion-to-extension ratio was 1.36±0.61, mean right-side-bridge-to-left-side-bridge ratio was 1.03±0.32, mean

Table-1: Trunk muscle endurance among club-level cricket bowlers.

Endurance Test	Mean±SD
Trunk Flexor Endurance Test (Seconds)	110.51±54.55
Trunk Extensor Endurance Test (Seconds)	84.72±33.15
Trunk Lateral Extensor Test (Right) (Seconds)	88.29±32.78
Trunk Lateral Extensor Test (Left) (Seconds)	88.54±34.17

Table-2: Mean values of trunk muscle endurance test time.

Endurance Test Ratios	Mean±SD
Flexion to Extension Ratio	1.36±0.61
Right Side bridge to Left Side bridge Ratio	1.03±0.32
Right Side bridge to Extension Ratio	1.10±0.37
Left Side bridge to Extension Ratio	1.10±0.38

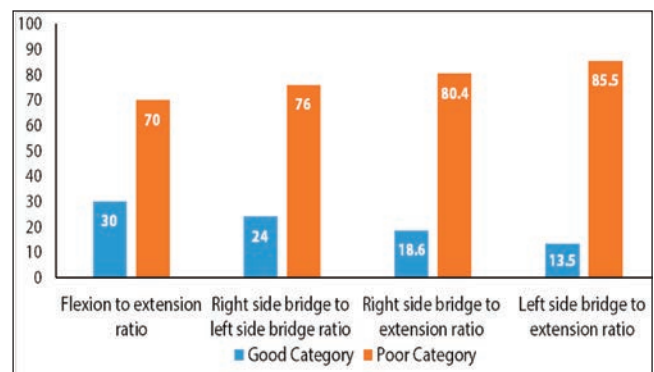


Figure: Distribution of players falling in the good and poor categories.

right-side-bridge-to-extension ratio was 1.10±0.37 and mean left-side-bridge-to-extension ratio was 1.10±0.38 (Table 2).

Categorising the trunk muscle endurance, 90(30.4%) bowlers had a good flexion-to-extension ratio, whereas 206(69.6%) had poor ratio. With respect to right-side-bridge-to-left-side-bridge ratio, 71(24%) players fell in the good category and 225(76%) in the poor category. The right-side-bridge-to-extension ratio was good in 55(18.6%) participants, and poor in 241(81.4%). The left-side-bridge-to-extension ratio was good in 40(13.5%) bowlers and poor in 256(86.5%) bowlers not case (Figure).

Discussion

The current study was conducted on cricket bowlers in the Rawalpindi and Islamabad region, and evaluated the lumbar core stability using the McGill's Torso Endurance Test Battery. The overall core stability in club-level cricket bowlers was poor. The average flexor endurance was 110 seconds, average extensor endurance was 84.2 seconds, trunk lateral extensor endurance for right side was 88.2 seconds, and it was 88.4 seconds for the left side. Similar to the current results, Jayoti Kataria et al. in 2018 studied core stability of cricket players in India and reported mean flexor endurance to be 75 seconds for left-side bridge and 56 seconds for the right side.²⁴

In the current study, the ratio of right-to-left-side-bridge was calculated on both sides, and 76% of the participants were in the poor category. Stuart et al. in 1999 studied trunk muscle endurance in males and females, and reported that for torso extension, women outperformed men in endurance times, but not for torso flexion or the side-bridge exercise, which involved the lateral flexor muscles. This could be because of the fact that the distribution of slow twitch muscle fibres that are more fatigue-resistant and more suited to endurance happens to be higher in women.²⁵ As the current study only consisted of male bowlers, this could be the reason of more players falling in the poor category. Casto et al. in 2022 showed that anthropometric traits of the participants, particularly mass, and shoulder muscle activation and exhaustion were significant factors for side-bridge test performance.²⁶ Since core stability and endurance tests in the current study leaned towards poor ratio, hence it is expected that this might affect the performance and other factors, such as balance, skill and neuromuscular control of the players.

Core stability exercises improve athletic performance and prevent injuries, reported Osama et al. in 2020.²⁷ Zohreh et al. in 2019 studied female kabaddi athletes and reported that using hopping with core-strengthening exercises might help the athletes become more balanced and resilient, which may help them avoid injury.²⁸

Jayoti Kataria et al. in 2018 analysed core stability of cricket players in India, and reported mean flexor endurance of 75 seconds, and side-bridge time on left as well as right side, 56 seconds.²⁴ The current participants showed somewhat better scores for flexor endurance, and for right-side and left-side bridge. It was observed that side-bridging was done by most bowlers with much ease and comfort because it was a part of their daily warm-up activities.

Gharote GM et al, in 2017 compared core stability in different sportsmen, and for cricket fast bowlers reported flexion 209.73, extension 121.55, right-side bridge 80.87, left-side bridge 100.54.²⁹ In the current study, flexion time was half of what the study²⁸ reported, but the participants showed better balance between flexor and extension endurance times. But the overall ratio was poor for majority of the participants. Similarly, the participants showed comparable time for side-bridge, but extension endurance time was less. Anderson D et al. In 2013 studied core strength testing to develop normative data for competitive athletes, and reported extension to be 114.9 seconds, right-side bridge 64.2 seconds, left-side bridge 62.6 seconds and flexion 192.4 seconds.³⁰ These values were comparable to the current findings. Olivier et al. in 2022 found that adolescent pace bowlers with better trunk muscle stability

bowled faster than those with a lower level of trunk stability, irrespective of their age, height and weight.⁸ Akhilesh et al. in 2021 studied different parameters affecting bowling speed, and observed that ball-release speed was strongly correlated with physical characteristics and was moderately affected by biomechanical factors.³¹

The current study has limitations as the core stability tests were generalised and did not differentiate between local and global core stabiliser muscles. A single reading of each core stability test at one particular time could have been affected by fatigue or some other factors, like dehydration. Moreover, the influence of diet and extra-curricular physical activities was not considered, which could affect the generalisability of the findings. Besides, the time of data-collection was not uniform as there was no proper schedule set for the players by the various clubs. Finally, since the current study only comprised male subjects, therefore future studies should include female cricket players as well.

On the basis of the findings, core strengthening must be encouraged and made a necessary part of training regime among club-level cricket players. Specific exercise regimens should be introduced for the players to improve their core balance, particularly by addressing the disparity between the various core muscle groups that the current study identified as imbalanced. The precise biomechanical elements causing the observed imbalance in core muscle groups among club-level cricket bowlers could be the subject of future research. In order to lower the risk of injury and to ensure that bowlers at the club level are physically prepared for competitive sports, policies should be implemented necessitating periodic checks of all components of physical fitness.

Conclusion

Club-level cricket bowlers were found to have good right and left lateral trunk endurance, but comparatively moderate lumbar flexor and extensor endurance. However, calculation of ratios between different core muscles group showed poor core muscle balance among the bowlers except for the lateral trunk muscle group.

Disclaimer: The text is based on an academic thesis.

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H: Data collection, statistical analysis, editing and writing.

SB: Data collection, statistical analysis and writing.

AI, MA: Topic selection, data collection and statistical analysis.

ZK: Concept, statistical analysis, review and final approval.

HABA: Concept, review and final approval.