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A relationship study between fast bowling velocity and lower body strength

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Abstract
The study investigated the link between lower body strength and fast bowling velocity in cricket among male medium pacers aged 17 to 25 years. Lower body strength was assessed using the 1 RM Squat Test and 1 RM Lunges Test following National Strength Conditioning Association guidelines, while bowling speed was measured with a Radar Speed Gun. Statistical analysis using SPSS software revealed strong positive correlations between bowling speed and lower body strength tests, underscoring the importance of lower body strength in power generation, impact absorption, speed enhancement, and technical efficiency in fast bowling. The findings supported existing research on this relationship and highlighted the inclusion of exercises like lunges and squats in training programs to target key muscles for optimal performance in bowling actions.

Keywords: Fast Bowling, lower body strength, bowling velocity, 1 rm squat test, 1 rm lunges test and correlation

Introduction

In ancient times, physical activity was essential for survival. Our ancestors relied on their physical abilities to hunt, gather, and defend themselves. Over time, as societies evolved, physical activity became a form of entertainment, social interaction, and competition. This led to the development of organized sports and games, which not only provided physical benefits but also promoted discipline, teamwork, and sportsmanship. In today's world, the importance of physical activity and sports cannot be overstated. Regular physical activity has been linked to numerous health benefits, including improved cardiovascular health, immunity reduced risk of chronic diseases, and better mental well-being. (Kumar & Jhajharia, 2018) [8] Furthermore, sports have the power to bring people together, bridge cultural gaps, and foster a sense of community.

The evolution of cricket as a sport has been influenced by various factors, including advancements in psychology, biomechanics, and the understanding of physiological development in the human body. (Gautam & Kumar, 2018) [2] Cricket is a game which have three components batting bowling and fielding, and advancements in science have played a crucial role in improving performance in each of these aspects.

These factors have played a crucial role in shaping the modern approach to cricket, both in terms of player performance and overall gameplay strategies. Psychology has become an integral part of cricket, with players and coaches recognizing the significance of mental resilience, focus, and decision-making on the field. Understanding and managing psychological factors such as performance anxiety, pressure situations, and confidence have become essential for players to excel in the sport. (Weissensteiner *et al*., 2012) [14] (Jadaun *et al*., 2021) [3] Biomechanics, on the other hand, has revolutionized the way players approach their techniques and movements in cricket. The analysis of body mechanics, joint movements, and muscle activation has led to the development of more efficient and effective batting, bowling, and fielding techniques. This understanding of biomechanics has not only improved player performance but has also helped in preventing injuries and enhancing overall player longevity. (Portus & Farrow, 2011) [12] In addition, the study of physiological development in the context of cricket has led to tailored training programs and fitness regimes that are aimed at optimizing player endurance, strength, and agility. (Kumar *et al*., 2021) [11] The knowledge of how the body responds to specific physical demands in cricket has allowed players to train more effectively and adapt to the rigorous demands of the sport. The physiology of a fast bowler in cricket encompasses a blend of physical attributes,

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biomechanics, and fitness elements that impact their performance. Key components include: Fast bowlers require specific physical traits such as tall stature and muscular upper bodies, strong upper and lower body muscles for generating force during the bowling action, essential leg muscles for power generation and balance, cardiovascular fitness for endurance, efficient biomechanics optimizing energy transfer and injury prevention strategies. (T., 2014) [13]. The correlation between lower body strength and fast bowling in cricket is a crucial aspect of a bowler's performance. Research suggests that effective lower body strength, particularly eccentric strength, plays a significant role in fast bowling. Bowlers with higher levels of leg power, as demonstrated through vertical jump tests, tend to have greater bowling speeds. Additionally, lower body power is considered a partial predictor of bowling speed among first-class bowlers.

Having optimal lower body strength can assist bowlers in maintaining proper form during the bowling action, such as keeping the front knee extended and absorbing impact forces when the front foot lands. The ability to generate power from the lower body is essential for transferring energy efficiently from the ground up through the body and into the bowling action. (Johnstone *et al*., 2014) [4] The aim of this study was to identify the correlation between lower body strength and fast bowling velocity.

Materials and Methods
Selection of Subject
Twenty (N=20) male fast bowlers from the different cricket academies of Bhopal Madhya Pradesh, India were selected as the subjects for this study. Medium pacers age was in between 17 to 25 years.

Selection of Variable
The present study aimed to identify the correlation between lower body strength and fast bowling velocity. Hence, the delimited variables for this study were bowling velocity and lower body strength.

Criterion Measure
The lower body strength was measured using the following 1 RM Test
1. 1 RM Squat Test
2. 1 RM Lunges Test

1 RM Squat Test and 1 RM Lunges Test protocols adopted by guidelines by the National Strength Conditioning Association and these 1 RM Squat Test were also used by (Kumar, 2023) [7] (Kumar & Jhajharia, 2020) [9] 1 RM Lunges Test (Kumar, 2023) [7] (Kumar & Jhajharia, 2022) [10] (Kumar, 2022) [5] in Indian conditions.
Bowling speed was measured using a Radar Speed Gun (Bushnell velocity speed gun 101911) in the study. The radar gun utilized Doppler signal processing to measure the speed of the balls thrown by the bowlers. It had an accuracy of +/- 1 mph and +/- 2 kph and was capable of measuring speeds ranging from 16-177 kph (27 meters away). The radar gun emitted radio waves at a specific frequency, and when a moving object (such as a thrown ball) entered this signal, the frequency of the reflected signal off the ball changed. This change in frequency was proportional to the ball's speed, allowing the radar gun to accurately measure the speed of each ball as it left the bowler's hand. The radar

gun displayed the speed in either kph or mph and could penetrate materials like Plexiglass, netting, fencing, backdrops, or tarpaulins without affecting the accuracy of the measurements. (Rohilla *et al*., 2022) [1]

Statistical Analysis
The data analysis was conducted using the Statistical Package for the Social Sciences (SPSS) software version 20.0. Descriptive statistics such as mean and standard deviation were computed, and statistical significance was determined with a p-value of less than 0.05. Pearson's correlation coefficients and corresponding p-values were utilized to explore the relationships between variables.

Results

Table 1: Descriptive statistics of selected variables

S. No.	Strength Test	Mean	Std. Dev
1.	1 RM Squat test (Kg)	76.16	6.75
2.	1 RM lunges test (Kg)	65.71	7.52
3.	Bowling Velocity (Km/h)	97.11	20.47

Table No. 1 illustrate descriptive data for 1RM Squat test and 1RM Lunges tests. The 1 RM Squat test had a mean and standard deviation of 76.16±6.75. 1 RM Lunges test had a mean and standard deviation of 65.71±7.52. The bowling velocity mean and standard deviation was 97.11±20.47.

Table 2: Correlation statistics between selected variables

Variables	Bowling Velocity (Km/h)
1 RM Squat test	0.674**
1 RM lunges test	0.701**
**Correlation is significant at the 0.01 level (2-tailed)	

Table No. 2 showed strong positive correlation between bowling speed and 1 RM Squat test and 1 RM lunges test (r=0.674, r=0.701 p-value <0.0001).

Discussion on Findings
This research highlighted, the physical attributes and fitness elements required for fast bowlers highlight the intricate connection between physiology and performance. The results of this correlation between lower body strength and fast bowling are aligned with research's by (Rohilla *et al*., 2022) [1] and (T., 2014) [13]. Lower body strength is a critical component in fast bowling in cricket, impacting various facets of the bowling action. The relationship between lower body strength and fast bowling speed is significant due to the following factors:
1. **Power Generation:** Strong lower body muscles, including the quadriceps, hamstrings, and glutes, are vital for generating power and efficiently transferring it from the ground through the body into the bowling action. This strength enables bowlers to push off forcefully and initiate the bowling motion with speed and power.
2. **Front Foot Impact:** Effective lower body strength, particularly eccentric strength, helps bowlers absorb the impact forces when the front foot lands during the delivery stride. This strength is crucial for maintaining balance, stability, and control throughout the bowling action.
3. **Bowling Speed:** Research indicates that bowlers with higher levels of lower body power, demonstrated

through tests like vertical jumps, tend to achieve greater bowling speeds. Lower body power serves as a partial predictor of bowling speed among first-class bowlers, highlighting the role of lower body strength in generating velocity during the delivery.

4. **Technical Efficiency:** Well-developed lower body muscles contribute to the stability and efficiency of the bowling action. A strong lower body helps bowlers maintain proper alignment, posture, and sequencing during the delivery, leading to more consistent and powerful performances on the field.

As a result, tailored training programs for fast bowlers often incorporate exercises such as lunges and squats, targeting the muscles essential for generating force and speed in their bowling actions. Lunges and squats are commonly incorporated into training programs for fast bowlers to develop lower body strength and power. These exercises target the muscles of the legs, hips, and core, allowing bowlers to generate more force and speed in their bowling actions.

Conclusion

The study aimed to investigate the relationship between lower body strength and fast bowling velocity in cricket. The subjects were male medium pacers aged between 17 to 25 years. The variables selected for the study were bowling velocity and lower body strength, measured through the 1 RM Squat Test and 1 RM Lunges Test following guidelines from the National Strength Conditioning Association. Bowling speed was measured using a Radar Speed Gun, which accurately captured the speed of the balls thrown by the bowlers. Statistical analysis was conducted using SPSS software, revealing descriptive statistics for the 1 RM Squat test, 1 RM Lunges test, and Bowling Velocity. Strong positive correlations were found between bowling speed and both lower body strength tests, indicating a significant relationship at the 0.01 level. The discussion on findings emphasized the importance of lower body strength in fast bowling, highlighting its role in power generation, front foot impact absorption, bowling speed enhancement, and technical efficiency. The study supported existing research on the correlation between lower body strength and fast bowling performance. Training programs for fast bowlers often include exercises like lunges and squats to target essential muscles for generating force and speed in bowling actions.

References

1. Rohilla A, Anand P, Authors C. Correlation between Bowling Speed and Lower Limb Explosive Power. Journal of Clinical and Diagnostic Research. 2022;16(3):YC05-YC07.
2. Gautam RK, Kumar A. Effects of deprivation of sleep on the catching accuracy in cricket. International Journal of Physiology, Nutrition and Physical Education. 2018;3(2):14-16. https://www.journalofsports.com/archives/2018/vol3/issue2/3-1-470
3. Jadaun R, Kumar DA, Singh D, Sisodia DA. A Comparative Study of COVID-19 Pandemic On Mental Toughness of National Level Players Of Selected Team Games. Nat. Volatiles & Essent. Oils. 2021;08(6):6583-6587. https://doi.org/https://doi.org/10.53555/nveo.v8i6.5618
4. Johnstone J, Mitchell AC, Hughes G, Watson T, Ford P, Garrett AT. The Athletic Profile of Fast Bowling in Cricket. The Journal of Strength and Conditioning Research. 2014;28(5):1465-1473. https://doi.org/10.1519/jsc.0b013e3182a20f8c
5. Kumar A. Relationship between quadriceps muscle fiber architecture and lunges performance. International Journal of Physiology, Nutrition and Physical Education. 2022;7(2):347-351. https://doi.org/https://doi.org/10.22271/journalofsport.2022.v7.i2f.2645
6. Kumar A. Muscle architecture a new dimension of talent identification: A mini review. International Journal of Applied Research. 2023;9(1):142-146. https://doi.org/https://doi.org/10.22271/allresearch.2023.v9.i1c.10476
7. Kumar A. Non-Invasive estimation of muscle fiber type using ultra Sonography. International Journal of Physical Education, Sports and Health. 2023;10(1):89-95. https://doi.org/https://doi.org/10.22271/kheljournal.2023.v10.i1b.2758
8. Kumar A, Jhajharia B. Effect of morning exercise on immunity. International Journal of Physiology, Nutrition and Physical Education. 2018;3(1):1987-1989. http://www.journalofsports.com/pdf/2018/vol3issue1/PartAI/3-1-432-841.pdf
9. Kumar A, Jhajharia B. Lunges Performance Predicted By Multiple Linear Regression Model with Muscle Architectural Parameters. Turkish Online Journal of Qualitative Inquiry (TOJQI). 2020;11(4):2510-2517. https://doi.org/https://doi.org/10.53555/tojqi.v11i4.10170
10. Kumar A, Jhajharia B. A Comparative Study of White Muscle and Red Muscle Fiber Architectural Parameters. Asian Pac. J Health Sci. 2022;9(3):46-49. https://doi.org/https://doi.org/10.21276/apjhs.2022.9.3.10
11. Kumar A, Khare S, Sisodia DA. An Aerobic Capacity Variable-Based Discriminant Model for the Classification of Handball Players. Nat. Volatiles & Essent. Oils. 2021;08(6):6544-6548. https://doi.org/https://doi.org/10.53555/nveo.v8i6.5598
12. Portus M, Farrow D. Enhancing cricket batting skill: implications for biomechanics and skill acquisition research and practice. Sports Biomechanics. 2011;10(4):294-305. https://doi.org/10.1080/14763141.2011.629674
13. T, GA. The Athletic Profile of Fast Bowling in Cricket: A Review. Kinesiology (Formerly Exercise and Sport Science), 2014, 32.
14. Weissensteiner JR, Farrow BAD, Gross J. Distinguishing psychological characteristics of expert cricket batsmen. Journal of Science and Medicine in Sport. 2012;15(1):74-79. https://doi.org/https://doi.org/10.1016/j.jsams.2011.07.003