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Impact of short-term functional training program on lower-body isometric muscle endurance in cricket players

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Abstract
This present research examines the impact of a short-term functional training (FT) program on lower-body isometric muscle endurance in cricket players. Thirty male inter-collegiate cricketers (aged 19-22) were engaged and divided into an experimental group (EG) (n=15) and a control group (CG) (n=15). The training group underwent a functional training program emphasizing multi-joint, sport-specific exercises, while the control group followed regular training routines. Lower-body isometric endurance was assessed using the wall squat test pre-and post-intervention. Statistical analysis showed significant improvements in the experimental group's lower-body isometric muscular endurance ($P<0.05$), while the control group showed no significant changes. These findings suggest that functional training, even in short-term applications, can significantly enhance lower-body isometric endurance in cricket players, aiding in sustained performance and reducing injury risk. This study proves that functional training may be an effective conditioning strategy for cricket athletes.

Keywords: Functional training, isometric endurance, explosive movements, traditional training

1. Introduction
Functional training (FT) programs have become increasingly popular in sports conditioning due to their comprehensive approach, which aims to improve vital elements like strength, flexibility, and coordination. Unlike traditional resistance training, FT emphasizes movements that closely mimic everyday activities, enhancing muscle coordination and joint stability. The focus of functional training is to help athletes, particularly cricket players to perform better by integrating exercises that replicate the physical and technical demands of their sport. This approach is grounded in the principle of specificity, meaning that training in movements directly related to the sport yields the most significant performance benefits (Hawley, 2008). Research by Doma and Deakin (2013) [5] highlights that both functional and resistance training effectively improve various fitness components in athletes. Functional exercises involving multi-joint movements can be scaled for both beginners and advanced athletes, activating muscle groups crucial for activities like running (Cassemiro *et al.*, 2017) [4]. Functional training also engages aerobic and anaerobic energy systems, providing a versatile workout (Ismail *et al.*, 2012) [10].
Functional training is regarded as the foundational approach to sport-specific physical fitness, prioritizing movement-based exercises rather than targeting isolated muscle adaptations, as is common in traditional resistance or strength training. The primary goal of functional training is to enhance athletic performance by using exercises that involve instability and improve motor control in sport-specific tasks. According to the principle of specificity, exercise that closely replicates natural daily movements is often the most effective approach for improving overall muscular fitness (Weiss *et al.*, 2010) [17].
Lower-body isometric muscular endurance is essential for cricket players, enhancing batting, bowling, fielding, and wicketkeeping performance. This type of endurance, which involves the ability of muscles to sustain a contraction without movement, helps players maintain stability and strength during prolonged periods of activity. Bowlers, particularly fast bowlers during

test matches, require lower-body endurance to generate force and support their stride throughout multiple deliveries, reducing the risk of muscle fatigue and injury. Similarly, batters rely on leg endurance to stay balanced and stable, enabling them to generate power for strong shots even during long innings. Fielders also benefit from lower-body endurance, as it allows them to stay in a low, ready position, ensuring quick acceleration and agility when responding to the ball. Wicketkeepers, who spend much of their time crouched, depend on solid quadriceps and hamstring endurance to react swiftly to delivery and stumping opportunities. Moreover, lower-body isometric endurance is critical in preventing injuries by providing joint stability in the knees, hips, and ankles, which are subject to high stress during explosive movements (Bailey *et al.*, 2007) [3]. Consequently, developing lower-body isometric endurance is vital for sustaining high-performance levels and reducing injury risks in cricket.

Functional training programs incorporate compound, multi-joint movements like squats, lunges, and static holds that challenge the lower body muscles in isometric contraction. These exercises target key muscle groups, including the quadriceps, hamstrings, and glutes, essential for sustaining static postures and explosive movements in cricket. Research suggests that even a short-term functional training program can improve muscle endurance by improving neuromuscular efficiency and muscular adaptation (Myer *et al.*, 2011) [12]. This leads to better performance in sustained postures, such as a bowler's stride, a batsman's stance, or a fielder's low position. A study by Behm and Anderson (2005) [2] found that functional training significantly improved isometric muscle endurance in the lower body by incorporating exercises that challenge balance, stability, and coordination. This is critical for cricket players who need to maintain lower body strength over extended periods during matches. Short-term programs, lasting 6-8 weeks, have produced measurable gains in muscular endurance, helping athletes sustain performance and reduce fatigue during prolonged play (Anderson & Behm, 2005) [2].

Research shows that short-term functional training programs can significantly enhance lower-body strength. Sperlich *et al.* (2017) found that even a brief functional training can improve leg strength and power among trained athletes. Additionally, studies have established a connection between muscle strength endurance and performance in one-day cricket. For instance, Noakes and Durandt estimated that a batsman scoring 100 runs in a one-day match would cover approximately 3.2 kilometers while running between wickets over a cumulative period of around 8 minutes. This emphasizes the importance of lower body isometric endurance, which allows batsmen to maintain pace and stamina throughout the game. They further noted that continuous and repetitive eccentric contractions during cricket require significant muscle strength, underscoring the physical demands placed on players during extended play.

The study intends to evaluate the influence of a twelve-week functional exercise practice on lower-body isometric muscle endurance in cricket players, focusing on enhancing performance, stability, and injury prevention. Improving isometric endurance in the lower body is critical for supporting the repeated physical demands of cricket, such as sprinting, bowling, and fielding, while minimizing the risk of overuse injuries.

2. Material and methods

2.1 Participants

Thirty male inter-collegiate cricket players aged 19 to 23 were recruited for the study using a purposive sampling method from a prominent cricket club in Trivandrum. All participants had at least three years of competitive cricket experience at the district level. Following the pre-test, the players were randomly assigned to either a control group (n=15) or an experimental group (n=15). Each subject provided written informed consent before the study, and ethical approval was obtained from the institutional ethical committee only players who had been injury-free for at least six months before testing were included in the study.

2.2 Procedures

A randomized controlled trial was carried out to assess the effects of functional training on isometric muscle endurance. Participants underwent pre-tests and post-tests one week before and after the exercise program. The post-tests were scheduled 72 hours after the last session to ensure adequate recovery. Participants were advised to avoid strenuous activities the day before testing and were restricted from engaging in intense exercise throughout the study. After an initial familiarization session and baseline assessments, participants engaged thrice weekly in a twelve-week High-Intensity Functional Training (HIFT) program. Each HIFT session included seven exercises, some performed for repetitions and others timed. The program started at 65% intensity for the first three weeks, and the intensity and complexity of the exercise were progressively increased every three weeks for optimal adaptation. The isometric muscle endurance of the participants was assessed by the "wall squat test" before and after the training program.

2.3 Statistical technique

Calculations were performed to determine each variable's average (M) and standard deviation (SD). The Shapiro-Wilk test was employed to examine the data's normality. A paired sample t-test assessed significant differences in pre-test and post-test outcomes for experimental and control groups. A significance level of 0.05 was established for all statistical analyses. The statistical data analysis was performed using version 26 of IBM SPSS Statistics software on Windows.

3. Results and Discussion

3.1 Results

Table 1: Descriptive statistics of EG and CG

Group	Pre-Test					Post-test				
	N	M	SD	V	SE	N	M	SD	V	SE
EG	15	2.15	.053	.003	.014	15	2.3	.15	.02	.039
CG	15	2.3	.03	.001	.008	15	2.11	.03	.001	.008

The FT group's pre-test mean lower body isometric muscle endurance was 33.46, with standard deviation (SD) of ±2.77. The pre-test mean lower body muscular endurance for the CG was 39.33, with SD of ±2.29. The post-test mean lower body isometric muscle endurance for the functional training group was 26.20, with SD of ±3.97. The post-test mean lower body isometric muscle endurance for the CG was 25.86, with SD of ±3.27.

Table 2: Paired sample 't' Test of EG and CG

Group	Pre- Test		Post Test		t	P
	M	SD	M	SD		
EG	2.15	.053	2.37	.15	5.49*	.000
CG	2.13	.03	2.11	.03	1.83	0.08

Table 2 shows the paired sample t-test for lower body isometric muscle endurance, indicating t-values of 5.49 and 1.83 for the FT group and CG respectively. The t-value 5.49 for the EG was significant ($p = 0.000$, $p < 0.05$), showing a notable improvement in lower body isometric muscle endurance after the post-test. However, the t-value for the CG (1.83) was not significant ($p = 0.\ 0.08$, $p > 0.05$).

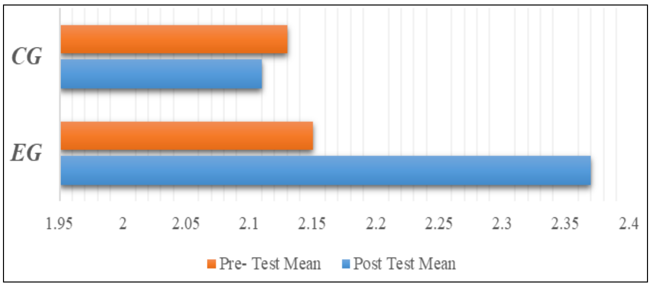

Fig 1: Pre and posttest mean value of EG and CG

4. Discussion

The current study shows a significant improvement in cricket players' lower body isometric muscle endurance after 12 weeks of the functional training program. Functional training exercises like squats, lunges, and isometric holds target multiple muscle groups simultaneously. By focusing on movements that mimic the demands of cricket, these exercises enhance the ability of lower body muscles (quadriceps, hamstrings, glutes) to sustain forces in static positions, such as maintaining a batting stance or holding a low, field-ready position.

In a study by Myer *et al.* (2011) [12], athletes who completed an 8-week functional training program showed significant gains in lower-body strength and power, evidenced by improved vertical jump performance and faster sprint times. These findings suggest that even short-term functional training can produce noticeable increases in leg strength and explosive power, which are crucial for cricket players in activities such as sprinting between wickets, bowling, and batting. Similarly, found that functional training enhances leg muscle strength and optimizes it for maximum speed, reinforcing its relevance in sports requiring quick bursts of movement.

Juneja *et al.* (2010) [11] also highlighted the predictive value of isometric strength testing for dynamic performance in strength-based activities, making it a valuable tool for athletes. Posnakidis *et al.* (2022) [1] similarly reported that an 8-week HIFT program led to marked gains in both upper- and lower-body muscular endurance, attributing these results to the increased ability to perform more repetitions within a set time (30 seconds). The cumulative number of repetitions performed in each session increased as training progressed, contributing to higher training loads and enhanced endurance. This improvement in muscular endurance is likely due to peripheral adaptations such as increased muscle oxidative capacity, greater capillary density, enhanced mitochondrial content and improved mitochondrial enzyme function as suggested by Fisher *et al.* (2014) [7] and Scott *et al.* (2019) [13]. These physiological changes facilitate greater efficiency in sustained muscular effort, further supporting the benefits of functional training in athletic performance.

5. Conclusion

Functional training emphasizes core and lower body integration, which helps cricketers maintain posture and reduce the risk of injury. By improving muscular endurance, players can maintain efficient movement patterns, which enhances performance in dynamic cricket activities like sprinting between wickets, bowling multiple overs, or fielding in quick succession. As a result, functional training is particularly beneficial for cricket players in improving their lower body isometric endurance over a short period. A short-term functional training program can improve cricket players' lower-body isometric muscle endurance.

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