



## Determination Of Combined Functional And Core Training Among Badminton And Tennis Players - A Systematic Review

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<i>Article History</i>	<i>Abstract</i>
<p>Received: Revised: Accepted:</p> <p>CC License CC-BY-NC-SA 4.0</p>	<p>Core strength training with functional training is gaining recognition and respect in the competitive sports training community in our country. In the past, strength training was focused on specific exercises, but now basic strength training is becoming increasingly popular as a training sport. In racket sports, the capability to swiftly and efficiently vary body direction and location while maintaining stability and postural orientation is key. It requires a harmonious execution of skills and strategies, involving dynamic and agile balancing.</p> <p><b>Purpose:</b> The purpose of the study is to evaluate the effectiveness of core strengthening and functional training on anaerobic power and muscular strength in racquet players.</p> <p><b>Study design:</b> Pre- and post-control group designs with pre-and post-test assessments were employed in this investigation. The methodology involved 40 subjects, both male and female, aged 18 to 25 years old, who had been training for at least 1-2 years and met the inclusion and exclusion criteria. Each participant provided me with general assessment information, such as age, height, weight, practice hours, and medical background. After that, the patients were divided into two groups of equal size. group A for training and group B for control. We evaluated the results before and after the 6-week program, which had three sessions per week.</p> <p><b>Measures of success</b> include the Star Excursion Power Test (a vertical leap test), the McCill Test for core muscle endurance, the Illinois Agility Test (IAT), the 10- and 20-meter sprint test (a speed test), the hand grip test (a hand dynamometer), and the flexibility test (a sit-and-reach test).</p> <p><b>Results:</b> The data was reported as mean SD for Group A (the training group) and Group B (the control group). At a significance level of 0.05%, statistical analysis was done using paired and unpaired t-tests to evaluate the statistical differences between the parameters.</p>

## INTRODUCTION

Badminton is a widely loved racquet sport that captivates players all over the globe. The game is known for its fast-paced, intense nature, with players engaging in short, repetitive actions on an 80-meter-long court. The combination of speed, agility, and precision makes badminton an exhilarating sport to watch and play. In badminton, players need to be able to swiftly change direction, execute quick arm movements, jump, lunge, and adapt to various positions on the court. That's why maintaining good balance and being agile in quick stance movements are crucial for badminton players.

Tennis has changed from being a technical skill-based sport to one that is now more active and fast. It now involves higher levels of speed in striking and serving, as well as increased physical demands. As the game of tennis continues to evolve, The importance of higher fitness levels is widely acknowledged among players for the effective execution of advanced shots and competitiveness against increasingly skilled opponents. To meet these demands, it is recommended that tennis players develop a well-rounded set of abilities, including coordination, strength, speed, and agility, as well as both aerobic and anaerobic capacities ranging from medium to high levels. In tennis, success is not solely determined by one specific physical attribute. Instead, it relies on the intricate interplay of various physical components and metabolic processes. It's the combination of these factors that contributes to a player's overall performance on the court.

Functional training is a fantastic way to engage multiple body systems through various exercises that target different parts of the body. It covers the whole body, enhances overall motor skills, and incorporates movements in different planes. These intensive and dynamic training sessions continuously evolve to challenge you. In the literature, exercises designed for functional training may have different rest ratios but share similar training content, such as gymnastics, weightlifting, and aerobic exercises. Muscular endurance is closely linked to strength and can lead to positive changes in body composition. While aerobic capacity plays a significant role in endurance, anaerobic capacity is less influential. Functional training not only improves muscular endurance, hypertrophy, strength, and power, but it also has a great impact on enhancing aerobic power and anaerobic capacity.

Core strength training has become a key component in competitive sports training, delivering impressive results across various athletic disciplines. In the sport of tennis, where explosive power and control are paramount, developing a strong core can greatly enhance an athlete's performance on the court. Drive theory suggests that core strength training plays a direct role in an athlete's body control, muscle movement recognition, and injury prevention. By improving power and efficiency, core strength training allows tennis players to maximize their stroke accuracy and hitting speed. If you're interested, there are article that examines the results of typical strength training and core strengthening on tennis players, specifically focusing on the core strength's effects on striking power and precision.

## METHODOLOGY

The research includes learning academic papers that have a linkage to keywords like core endurance learning, functional training learning, and badminton and tennis sport. "Core strengthening," "functional training," "agility," and "power" are the search criteria for racquet sports on technological devices. 9.39% of badminton players and 3.33% of tennis players in India are active in sports. Badminton and tennis are considered of some risk of injuries as well which is a contributory risk factor for the players. So, a number of research questions are developed in order to evaluate every article and gather important information. These study inquiries, which aim to improve data collection, are as follows:

**Q1** What is the benefit of core training in racquet sports?

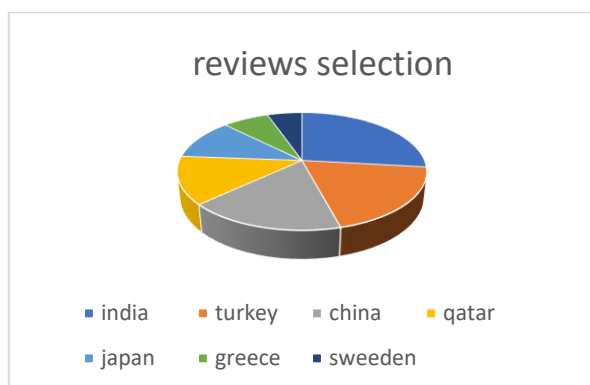
**Q2** What strategies are processed by the badminton and tennis players to make their game more efficient?

**Q3** What are the best strategies for encouraging Indian athletes to combine their traditional training with core and functional exercises?

**Q4** What are the benefits of functional training on different variables of physical fitness?

**Q5:** Are injuries are preventable by this training?

The work is verified and included in this systematic review using an effective criterion, as indicated in fig1.



## REVIEW OF LITERATURE

This section provides a summary of the approaches employed and reviews of publications that have been previously accepted in the field of functional training and core endurance workouts of different body parameters in racquet sports.

### Q1: What is the benefit of core training in racquet sports?

Core strength training is a key component in modest athletic training. It has shown impressive results by maximizing an athlete's power and precision in various sports. According to the kinematic chain theory, core strength training has a direct impact on an athlete's body. It enhances their ability to control the central parts of the body, recognize muscle movements, and reduce the risk of injury. By improving core strength, athletes can increase their power and optimize their stroke accuracy.

Core muscles, like the transverse abdominal muscle and oblique muscles, stabilize the thorax and pelvis during movement. They also provide internal pressure for expelling substances. Static core functionally refers to the core's ability to align the skeleton and resist unchanging forces. Core strength training is crucial for preventing lower and knee joint injuries. The core muscles, including overall and local muscles, help maintain posture, assist in changing postures, and support dynamic movements. They transfer force and serve as a link between the upper and lower extremities, providing protection and support for the spine. Core stability exercises have been widely used to reduce injuries in the lower back and lower extremities. Core stability training has gained recognition for its potential to enhance player performance. In athletic contexts, core stability refers to the ability to efficiently transfer and manage force from the body's center to the limbs, achieved through stabilizing the position and movement of the torso. It also involves central motor control of the lumbar-pelvic area to maintain core stability against various postural and external forces.

The serve needs skill and strength, including a strong core, to achieve maximum velocity. So, is there a direct connection between core strength and serve speed? And can improving core strength help increase serve velocity?

Author	Training	Result
Cui Mengyao, Seung-sooback	developing the core for tennis players.	Young tennis players' physical prowess may be improved by core strength training, especially in the areas of speed, endurance, and body stability.
Mengyao Xie (2016)	Core strength training in badminton	interconnection of upper and lower limbs connecting, with coordination and injury prevention.
Dass et; al. (2021)	Plyometric and core training in badminton players	the plyometric training not only improves the agility or anaerobic power but also strengthens the core which is the power-generator of the body.
Baton Rouge et; al, (2012)	Endurance test reliability by core stability measurements.	Tests of core endurance are thought to be the most accurate for assessing sports performance. The next essential markers are flexibility, strength, neuromuscular control, and functional testing.
Egesoy et; al, (2021)	static and dynamic core training on tennis athletes.	Core training has a positive impact on the ground strike speed and various motoric properties of athletes. This is because of the functional structure of the core, which contributes to improved performance.
Churi & Varadharajulu	core strengthen and conditioning	after 4 weeks of core training players showed development in their core strength

## Q2: What strategies are processed by the badminton and tennis players to make their game more efficient?

Badminton is a dynamic and diverse sport that requires players to have a wide range of motion. Nowadays, the trend in badminton is all about being fast, accurate, aggressive, and dynamic. The ability to handle the unpredictable factors such as the direction, angle, and arc distance of the shuttlecock is crucial for maintaining stability and delivering effective returns.

Author	Strategies	Results
Gowitzke and waddell (1986)	Effective teaching of racquet sports.	Biomechanical information upper limb movements
J. Malliou; et; al, (2010)	Balance and coordination over fatigue	The study's findings showed that a top tennis player's balance performance was not significantly harmed by a tennis training session. This is great news, as it suggests that their balance abilities remained stable during the training session.
Chico; et; al,	Key factors of double badminton according to ages	Coaches play a crucial role in guiding players' career paths and providing advice on transitioning between different sports or training modalities. They take into account things like the different physical requirements and the age at which peak performance is attained.
Yu; et; al, (2019)	Different training methods for sprint training	To enhance maximum speed, it's crucial to combine speed training methods with speed strength training. This combination works particularly well to raise the body's center of gravity's top running displacement speed.

Tennis is a challenging sport that requires intricate motor movements and a strong management between your legs, hands, and eyes. Because tennis is a multidirectional sport and matches may run up to three hours, having strong balancing abilities is even more important. To avoid injuries, rehab specialists recommend tailored exercise programs. These may include strength exercises to address muscle imbalances, stretching exercises to reduce stiffness, and balance exercises to enhance proprioception. It's crucial to follow these programs for a safe and effective recovery. Tennis is a dynamic and explosive sport that involves powerful strokes and serves, demanding a higher level of physical fitness. Players require a solid mix of speed, agility, coordination, and power, as well as a good aerobic and anaerobic capacity, to perform well against elite opponents. It's essential to focus on developing these skills to perform advanced shots and compete effectively in the game of tennis. Keep pushing yourself and striving for excellence on the court

Tennis and badminton players both benefit greatly from being physically healthy. Functional training, which focuses on core training, is a modern exercise approach that is often overlooked in the current development of competitive sports. Recognizing the importance of core strength and incorporating functional training into your routine can greatly enhance your game performance. Functional training has been proven to have a significant impact on international high-level athletes. It effectively enhances an athlete's movement and control, making it a crucial tool for improving overall technique. Embracing functional training can take your skills to new heights and help you reach your full potential as an athlete. Keep pushing yourself and incorporating functional training into your routine to see remarkable improvements in your performance.

## Q3 What are the best strategies for encouraging Indian athletes to combine their traditional training with core and functional exercises?

Functional training aims to enhance performance in one movement by improving the entire neuromuscular system, which in turn positively impacts other movements. It's a technique for conditioning the body to deal with difficulties like balance, stability, twisting, bending, and lifting that arise in everyday life. The impact of functional training on elderly individuals, as well as those with diseases or injuries, has been extensively studied. Recently, functional training has gained popularity in the advanced sports world and has become quite the buzzword. It's exciting to see how this training approach is being recognized and embraced for its effectiveness. Functional training has been extensively studied in various sports, including football and

Author	Variables	Result
Wang; et; al, (2022)	Core strength	The experimental group showed significant improvements in both the left and right bridge tests, as well as the abdominal fatigue test, before and after the experiment. These findings demonstrate how core strength training improves tennis players' core competencies.
Zirhli and Demirci (2020)	Biomotor skills, such as the 10-m Speed Test, Vertical Leap Test, Sit Down Test, Grip Force Test, Agility Test (T-Test), and Anaerobic Power.	There was a discernible and substantial improvement in the experimental group that completed functional tennis training when comparing the pre-test and post-test scores. This demonstrates the positive impact of incorporating functional training methods into tennis practice.
Khatoon & Thiyagarajan	Agility and balance in elite badminton players.	both Group A (Pilates) and Group B (Plyometric) showed positive effects on dynamic balance, core muscle endurance, and agility. In terms of superiority, there was, however, no discernible difference between the two treatment plans. In order to improve certain areas of physical performance, both strategies work well..
Lori s. et; al,	Speed, Agility, and quickness in tennis athletes	Enhancement in all three parameters.

volleyball. In a study by Rosch et al. (2000), they found that functional training improved flexibility, power, speed, endurance, and football skills in football players. Similarly, Oliver and Brezz (2009) observed improvements in fitness levels through functional balance training in women volleyball players. These studies highlight the positive effects of functional training on athletic performance.

Core strength plays a key role in physical activity as it is fundamental to improving overall physical ability and has a significant impact on athletes' mastery of sports skills. By focusing on developing core strength, athletes can enhance their performance and excel in their respective sports.

#### Q4 : What is the benefit of functional training on diverse variables of physical fitness?

Author	Training	Benefits
Usgu et; al; (2020)	Functional training in basketball players	improved T-drill agility scores, upper and lower body strength, flexibility, and capacity for vertical jumps
Weiss, et; al; (2010)	Functional resistance training in young adults	Functional resistance training offers a unique and innovative approach to enhancing performance in young adults, surpassing traditional exercises. What's even more exciting is that this method can be applied to individuals of all ages and physical abilities, making it a versatile and inclusive training option.
Yildiz et; al; (2019)	Functional training	When it comes to preadolescent children, it's important to prioritize exercises and games that focus on enhancing basic mobility skills rather than intense training of sport-specific skills. By following this principle, we can ensure a solid foundation of movement and physical literacy, setting the stage for future athletic development.



Functional training focuses on incorporating both upper and lower body movements, engaging multiple muscles and joints in each exercise. Unlike traditional isolated muscle training, functional training emphasizes exercises that mimic real-life movements. This approach enhances overall functional fitness and supports the idea of training specific movements for specific activities. Functional training is indeed advantageous because it encompasses natural movements that occur in various planes and involve multiple joints, rather than isolating specific muscles. By training in this way, you can enhance your overall functional fitness and better prepare your body for the diverse movements required in daily activities and sports.

To optimize your serve performance in tennis and badminton, I recommend incorporating strength and conditioning exercises that target the key muscles involved in the serve. Focus on exercises that enhance acceleration and explosiveness, such as plyometric exercises, medicine ball throws, and resistance training for the upper body and core. As was mentioned, the lower body, trunk, and upper extremities all function as links in the body's kinetic chain, therefore these exercises offer a training stimulus for the complete body.

Author	Training	Benefits
Ming-min & Qing (2013)	Functional training in badminton	improve kinaesthetic and reduce injuries
Roebrat et.al;	strength training	Ensure the development of the key muscles necessary for power progression and transfer during an elite tennis serve.

#### Q.5:is injuries are preventable by this training?

Core strength and functional training are essential components in both tennis and badminton. In these sports, players must adapt their body positions to the changing court environment, technique variations, and tactical implementations during competitions. Having a strong core allows players to dynamically adjust their body postures to effectively handle the demands of the game. Using incorrect techniques can increase the risk of injury and affect the execution of a move. By focusing on proper execution, players can better handle different situations and minimize the chances of injury. Each technique relies on the coordination between the four limbs and the core muscle group, allowing for functional movements that engage multiple muscles.

Author	Training	Preventions
Brocherie, et; al; (2013)	Adding anthropometric measures	The reason behind this is that having an anthropometric profile like yours helps prevent the need to repeatedly lift excess weight (fat mass) against gravity during maximal sprinting. This can lead to improved sprinting performance and efficiency
Chandler et.al,	Flexibility in tennis players.	Tennis players have suggested a flexibility program tailored to their sport. A regimen like this has the benefit of reducing overload injuries, which are frequent among tennis players, and enhancing player performance.
Yilmaz (2022)	Training effect on acute badminton players on some Biometric parameters	Individuals' flexibility, response, vertical leap, and agility performances were better after using a badminton-specific training approach than they were before.
Sonoda.et.al, (2017)	Agility and lower limb strength	hip extension affects the speed of direction and ankle plantar flexion affects side-step speed and change of direction. In the future, an intervention study that shows whether hip extension and ankle plantar flexion strength training develop agility should be performed.

The level of an athlete's skills and tactics is greatly influenced by the intensity of core strength and functional movement. The higher the intensity of these training aspects, the better the athlete's movement ability and technical level. This is especially important for adolescents, as the intensity of their training can significantly

impact their overall development and performance. In interviews with tennis legends like Roger Federer and Novak Djokovic, Joel Press found that the core muscles and functional movements play a crucial role in enabling swift body movements and unleashing one's strength on the tennis court. The stronger the core, the greater the body's stability and precision in executing technical movements during a match.

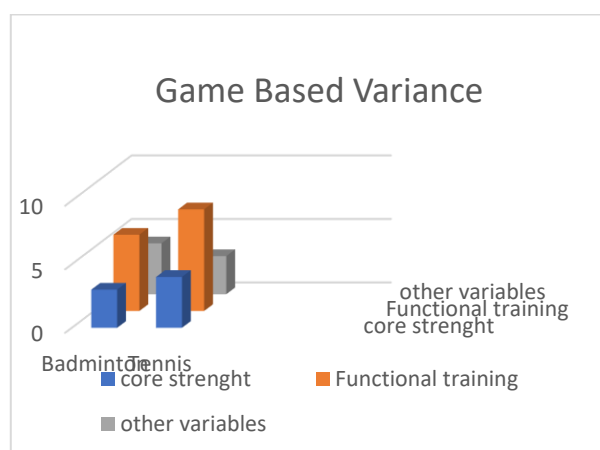
### DISCUSSION: -

Investigating the impact of combining core endurance and functional training on various player physical characteristics was the goal of a study investigation. According to the study's findings, the core and functional training regimens together significantly improved the various physical characteristics seen in the experimental group. According to research, core and functional training can be a useful strategy for enhancing athletes' performance.

Author	Method	Accuracy
Majewska et; al,	Pre and post data compression	(p<0.001)
Fernandez et, al; (2020)	Experimental study	(p<0.005)
Solanki & Gill (2021)	Evidence base study	(p<0.001)
Garg & Aasi	Experimental study	(P<0.001)

### COMMON FINDING: -

As far as I'm aware, there haven't been any studies done on the use of racquet sports by those that combine core and functional training. In comparison to most of the performance components, the current study found particular improvements. The physical variables as,



Indicated by the means and standard.

deviation, showed improvement from the pre-test to the post-test. This finding suggests that the combination of functional exercises and core endurance activities had a significant impact on speed, flexibility, hand grip, power, agility, and core endurance. The player's performance in racquet sports was positively impacted by the functional training programs. The strength, explosive power, and flexibility significantly improved, with the post-test values surpassing the pre-test values. Additionally, there was a significant increase in muscular endurance.

### Conclusion: -

In this paper, we have reviewed 40, papers out of which we discovered that the basic training followed are core endurance and functional training with different physical variables. But both are not combined with each other, individually these training have a positive impact on variables of fitness, we have observed that a combination of both has a nicer impact on different variables of fitness. Further research should be done on this to be clearer about the impacts and benefits of training and to prevent more injuries in different body parts.

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