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REVIEW ARTICLE

# Evaluating the Impact of Training Techniques and Physical Performance on the Development of Court Tennis Drive Stroke Skills: A Literature Review

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**Abstract**

**Objectives.** The objective of the study was to develop a training program and improve physical performance through a review of the literature in order to enhance the field tennis drive stroke.

**Materials and methods.** A comprehensive analysis of earlier research was carried out, comprising a review of articles published between 2019 and 2024 that discuss ways to improve the physical condition of tennis players. Electronic searches were conducted using SPORTDiscus, PubMed, Google Scholar, Web of Science, and Scopus. The articles addressing the most effective methods for enhancing court tennis drive stroke abilities through physical performance and practice techniques were then compiled.

**Results.** The findings of this study indicate that forty articles used physical performance techniques and practice to enhance the court tennis drive stroke. Based on the physical state assessments and its subsequent improvements, items were categorised. Anaerobic speed endurance has been defined as a training method that may be used by an athlete.

**Conclusions.** The following conclusions were reached after a thorough analysis: while physical performance includes muscle strength, aerobic and anaerobic endurance, speed and acceleration, explosiveness, flexibility, agility, and balance, a number of training regimens were found to be effective in improving the skills of the court tennis drive stroke. These training methods include circuit training, strength training, endurance training, kinesthetics' perception training, shadow sports training, rope ball training, interval training, and training frequency.

**Keywords:** review of the literature, exercise regimens, physical state, drive strokes, court tennis.

## Introduction

In order to attract and increase the desire to study court tennis, college tennis instruction should be structured in accordance with the qualities of the game as well as psychological aspects associated to kinesthetics' perception. University students must go through a lengthy process to develop their tennis playing abilities. The ability to play court tennis better, particularly on the drive shot, requires deliberate and ongoing work. There should be components of personalised instruction and training in this exercise. To do this, pragmatic methods and techniques are required (Amni & Sulaiman, 2019; Soegiyanto & Nugroho, 2012; Tegar Prastawa, Wimba, Hadi Husnul, Dwi Pradipta, 2022). Rather, the goal of this study is to provide the fundamental knowledge of the drive stroke. In this instance, court tennis driving strokes forehand and backhand will be taught to college students (Kolman et al., 2019).

Applying norms and principles pertaining to attitude, mentality, sportsmanship, emotions, and social interactions is vital to help students become better at mastering court tennis techniques (Fauzi et al., 2021). To attain good performance, all of this is required (Jariono et al., 2021, 2024; H. Nugroho et al., 2021). Technique, tactics, strategy, and mindset all crucial elements of the training principles need to be trained in order to do this. Bompa & Buzzichelli, (2019) states that sports training entails mental, technical, tactical, and physical preparation. A pupil needs to be

proficient in every area of the workout in order to attain the optimum results. To accomplish its intended purpose, each component thus needs unique care and attention.

To become better in playing court tennis, students must receive training (Anderson et al., 2021). This is because an integrated training process is the only way for students to succeed (Amico & Schaefer, 2022). Coaches and educators need to be trained in the areas of physical, technical, tactical, and mental health (Dohme et al., 2019). Since learning the proper technique would enable pupils to execute forehand and backhand drive strokes with efficiency, techniques need to be well-trained and developed (Faber et al., 2021).

The findings demonstrated that researchers may enhance the training curriculum and provide training materials that are tailored to the requirements of tennis players while they play by drawing on their expertise as court tennis course instructors throughout several meetings. Tennis players who are new to the game and frequently participate in tournaments should have an improved playing pattern. They will become more automated as a result of this. You must so comprehend the fundamentals of court tennis playing patterns. The aforementioned principles encompass the following: (1) backhand drive strokes and forehand groundstrokes; (2) tennis is an error-prone game; (3) every drive shot aims to create space in the opponent's court; (4) maintain the opponent's movement throughout the court; (5) comprehend the opponent's game; (6) comprehend the playing environment; and (7) acknowledge position.

## Materials and methods

### *Database and Search Profile*

Researchers used a range of databases, such as SPORTDiscus, PubMed, Google Scholar, Web of Science, and Scopus, to conduct systematic, controlled literature searches on their own. The terms "Training Methods," "Physical Performance," "Improving Drive Shot Skills," "Court Tennis," and "simultaneous strength and endurance training," as well as "combined strength and endurance training," were used in the search. The search includes only the English manuscript's entire text. All studies and experiments involving humans that were published between January 1, 2019, and May 30, 2024 the end of the search period was examined. Getting in touch with reputable research groups on the subject and looking through a reference list of certain articles are two more manual search techniques. Papers for the meta-analysis were chosen using the PRISMA Statement for Meta-analysis, which covers Identification, Screening (Page et al., 2021), Eligibility, and Inclusion, following a review of the literature. First, an electronic search of the SPORTDiscus, PubMed, Google Scholar, Web of Science, and Scopus databases yielded 750 identified articles and no duplicate articles were found. Then 400 articles were filtered by title and abstract, leaving 350 articles to reread. The results left a total of 200 articles reviewed. Of the 200 articles, 150 articles were eliminated into 40 papers (Fig. 1). In addition, table 1 explains the inclusion and exclusion criteria.

### *Methodological Quality Assessment*

Eleven PEDro (Physiotherapy Evidence Database) criteria were used to evaluate the quality of the publications under study, and their methodological quality was also appraised (Cashin & McAuley, 2020). Good articles are essential for helping users get past obstacles like time constraints and poor critical thinking abilities. They also make it simpler to incorporate excellent clinical research into clinical practice (Moseley et al., 2020). Guidelines for clinical practice and systematic reviews are not assessed. As per the findings of Moseley et al. (2020), methodological quality of papers was classified as follows: eight to eleven was considered high, four to seven was considered medium, and four or less was considered low.

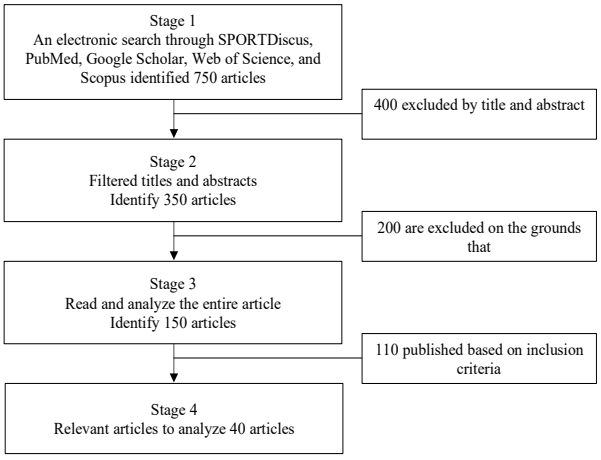


**Fig. 1.** Article identification flowchart in systematic review

**Table 1.** Inclusion and exclusion criteria of a systematic review

| Criteria | Category | | |
|---|---|---|---|
| | **Population** | **Intervention** | **Comparison** |
| Inclusion Criteria | Court Tennis athletes, without restrictions on physical condition, gender or age | Physical condition training programs, with a minimum duration of ≥3 weeks that include unilateral and bilateral jumps, which usually use pre-stretching or Countermovement emphasizing stretch-shortening cycles | Control group (i.e., standard exercise training, alternative training intervention, physically active, inactive). |
| Exclusive Criteria | Participants with health problems (e.g., injury, recent surgery), hindering Participation in plyometric jump training plan | The exercise intervention did not involve plyometric jumping exercises (e.g., upper body plyometrics is only a training intervention) or training interventions involving Circuit jumping training programs that represent less than 50% of the total training load (i.e., volume, for example, number of exercises) when delivered in along with other training interventions | Absence of a control group. |

## Results

### *Number of Results Reviewed*

750 papers were found using electronic searches on SPORTDiscus, PubMed, Google Scholar, Web of Science, and Scopus; no duplicate articles were discovered. 350 articles remained after 400 were sifted by title and abstract, making them suitable for further reading. A total of 200 articles were reviewed after the results. Out of the 200 articles, 40 articles that satisfied the PEDro scale's qualifying requirements remained after 160 articles were removed. Physical conditions are used to organise this article (table 2).

### *Exercise Significance Results*

Among the forty articles that were chosen and scrutinised, improvements in court tennis drive stroke skills were found in all forty of the selected articles. These improvements were observed irrespective of the players' experience level, gender, age, professionalism, or method of training.

## Discussion

### *Circuit Training*

To switch up your muscle parts with more effort and a quicker recovery time, try circuit exercises (Annasai et al., 2023). 60-90 second rest intervals separated by one to three minutes between circuits. Exercises should be selected to improve the body's field as the primary mover in accordance with the goals of the stages involved in preparation, particularly the goal of anatomical adaptation (Yulianto & Yudhistira, 2021). Showed that the benefits of training with a circuit include: a) simultaneously improving multiple physical condition components in a relatively short amount of time; b) allowing each athlete to train in accordance with his or her progress; c) allowing each sport to correct the athlete's progress; d) making training easy to supervise; and e) saving time because a circuit can accommodate multiple people practicing at once in a relatively short amount of time (Bompa & Buzzichelli, 2018).

It is improper to compare athletes using the Circuit or to use it as a test. Athletes' rapid performance makes it unfair

**Table 2.** Characteristics and results of physical condition training methods for tennis players

| No | Author, Year | Physical Condition Variable | Training Type |
|---|---|---|---|
| 1 | Sharma et al., 2024 | Psychological factors affect performance | Visual motor behaviour rehearsal (VMBR) training program three times a week |
| 2 | Shuzhen Ma et al., 2024 | Core strength training on the badminton player's performance | A systematic review & meta-analysis |
| 3 | Zhang, 2024 | Optimization of college tennis training | Teaching under deep learning |
| 4 | Williams et al., 2024 | Determined by a racket embedded magnetic inertial measurement unit embedded magnetic-inertial measurement unit | Racket orientation angle differences between accurate and inaccurate squash shots |
| 5 | Williamson et al., 2024 | Physical demands of wheelchair tennis match play | A systematic review with meta-analysis |
| 6 | Büttner et al., 2024 | The power of human touch | Physical contact improves performance in basketball free throws |
| 7 | Kumar & Das, 2024 | Biomechanics impacting tennis performance on the world stage | A bibliometric analysis |
| 8 | Jariono et al., 2024 | Physical activity training methods to improve the physical condition of volleyball players | A systematic review |
| 9 | D. Nugroho et al., 2023 | Tennis groundstroke skills of sports students | Effects of massed and distributed drills, muscle strength, and intelligence quotients |
| 10 | Kaplan, 2023 | Accuracy performance tennis | Effect of 12 weeks of tennis education |
| 11 | Wood et al., 2023 | Kinematics and performance | The expert eye? An inter-rater comparison of elite tennis serves |
| 12 | Díaz-García et al., 2023 | Speed and accuracy | Brain endurance training improves shot |
| 13 | Irawan et al., 2023 | Biomechanical motion of the tennis forehand stroke | Analysing the impact on the ball speed using bio for analysis software |
| 14 | Rodríguez-Perea et al., 2023 | Core training and performance | A systematic review with meta-analysis |
| 15 | Deng et al., 2022 | Effects of plyometric training on skill and physical performance in healthy tennis players | A systematic review and meta-analysis |
| 16 | Colomar et al., 2022 | Determinant physical factors of tennis serve velocity | A brief review |
| 17 | Rusdiana et al., 2022 | Backhand drive stroke technique in tennis | 3D biomechanical analysis approach |
| 18 | James et al., 2022 | Upper-body post-activation performance enhancement for athletic performance | A systematic review with meta-analysis and recommendations for future research |
| 19 | Saeterbakken et al., 2022 | Trunk muscle training on physical fitness and sport-specific performance | A systematic review and meta-analysis |
| 20 | Renshaw et al., 2022 | Psychology: an ecological dynamics approach to motor learning in practice | Reframing the learning and performing relationship in high-performance sport |
| 21 | M. A. Chen et al., 2021 | Performance and technique | Effects of biofeedback |
| 22 | Aloui et al., 2021 | Physical performance | Effects of elastic band plyometric training |
| 23 | Rohadi et al., 2021 | Groundstroke forehand drive ability in novice tennis athletes | Effect of drill, foot position, and hand-eye coordination |
| 24 | Habay et al., 2021 | Mental fatigue and sport-specific psychomotor performance | A systematic review |

**Table 2** (continued)

| No | Author, Year | Physical Condition Variable | Training Type |
|---|---|---|---|
| 25 | Zacharakis et al., 2020 | Balancing and technical skills in | Effect of balance and proprioceptive training |
| 26 | Kitamura et al., 2020 | Skill performance | Strength and power training |
| 27 | Woods et al., 2020 | Performance preparation models in contemporary high-level sport guided by an ecological dynamics framework | Theory to practice |
| 28 | Hammami et al., 2020 | Physical performance | Effects of upper and lower limb plyometric training program on components |
| 29 | Vicente et al., 2020 | Physical activity and tactical behaviour | Effects of 6 weeks of direct instruction and teaching games for understanding programs |
| 30 | Turna, 2020 | Biomotor abilities | Effects of 6-week core training |
| 31 | Fardilha & Allen, 2020 | Defining, assessing, and developing creativity in sport | A systematic narrative review |
| 32 | Wilkins et al., 2020 | Insights, challenges, and accomplishments to guide future studies | An early review of stroboscopic visual training |
| 33 | K. Chen et al., 2019 | Motor skill learning | Exercise training |
| 34 | Mohanta et al., 2019 | Strength, speed, and agility | A comparative study circuit training and plyometric training |
| 35 | Zghal et al., 2019 | Physical fitness | Combined resistance and plyometric training are more effective than plyometric training alone |
| 36 | Gantois et al., 2019 | both anaerobic and aerobic fitness | Repeated sprint training |
| 37 | Payne et al., 2019 | Anxiety-attention relationship in far-aiming skills | A systematic review |
| 38 | Hagan Jnr & Schack, 2019 | Integrating pre-game rituals and pre-performance routines in a culture-specific context | Implications for sport psychology consultancy |
| 39 | Devonport et al., 2019 | Identity among high performance | Examining the construction |

to compare them (Shah, 2024). Rather, accomplishments should only be evaluated in relation to the skills of former competitors. According to S. Nugroho et al., (2021) the Circuit can be utilised during the first week of anatomical adaption. To determine the load for the primary movements, begin by assessing the athlete for RM 1 (Raj & Maniazhagu, 2022). Select circuit stations based on the requirements of the exercise regimen (Hu et al., 2024). Depending on the athlete's ability and training history, a specific progression plan needs to be followed (Ratajczak et al., 2024). Start with body weight exercises for novice exercisers who have never done any strength training (Themistocleous et al., 2021).

### *Strength Exercises*

The most important factor that forms the foundation for other aspects of physical condition is strength. It is among the physical requirements for practically every sport (Balachandran et al., 2022). To catch trainers' attention, it is crucial to increase the strength component's capacity. According to the demands of each sport, strength is a component of physical condition that can be maximally developed (Ottinger et al., 2022). Sports games will not require the same level of strength as weightlifting (Schumann et al., 2022). The ability of muscles to exert maximal effort while doing continuous or repetitive labour against resistance is another definition of muscle strength (Suarez-Arrones & Loturco, 2022).

### *Training for Endurance*

One of the key components of motor skills is endurance, which comes from students' psychological ability to support movement at a specific moment (Lucas et al., 2020). The capacity of muscles to continue moving during high-intensity or static exercise is known as muscular endurance (Huiberts et al., 2024). A condition that stresses the ability to labour continuously in an aerobic environment is called endurance. The capacity to work for a prolonged amount of time without experiencing severe exhaustion is known as endurance (Prieto-Gonz, 2022). When it comes to working muscles, endurance is the capacity to operate a muscle or group of muscles in a specific amount of time, whereas the energy system is the body's ability to function its organs in a specific amount of time (Düking et al., 2021).

### *Training in Kinesthetics' Perception*

In order to improve a fencer's performance of fencing techniques and her awareness of all the variables surrounding her during the technical performance, kinesthetics' perception is a crucial and necessary component of the sport (Tinaz et al., 2022). During an attack, defences, response, and countermovement's, make the right choice regarding the proper kinetic response (Mashkoor & Hameed, 2022). When a person's senses are stimulated, their body or certain body parts move concurrently, a phenomenon known as kinesthetics' perception occurs (Latash, 2024). Therefore, because the five senses are more accurate at controlling movement, feelings can provide information about the position of the body or body parts so that they move further (Wuang & Huang, 2022). According to Peng et al., (2023), this suggests that the human body has the ability to sense and maintain its position in order to control movements or decide how much muscle work will be done consciously. As a result, the activities that are produced involve a lot of calculations and can eventually be performed in a time-sensitive manner and turn into motion automation.

Perception of different modalities is known to be dependent on a continuing action-related efferent process (Latash, 2024). Kinesthetics' sense, also known as kinesthetics' per-

ception, refers to sensory input that takes place within the body (Wuang et al., 2021). By extending the body's muscles, the sensory system receives information about movement and posture. The kinesthetics' senses are capable of tracking the body's position even while it is still. Accordingly, the human body's organs that are directly connected to movement have a role in the kinesthetics' sense (Kumari et al., 2023). The capacity to take in the postures and movements of the body as well as its components provides a more practical grasp of kinesthetics' awareness (Fritz et al., 2022). A sensation known as kinesthetics' perception is brought on by activation of muscle receptors, muscle fascia, tendons, and joints. These structures serve as a feedback mechanism, allowing an individual to perceive their body's position or specific body parts in order to control movements more precisely or accurately.

*Sport of Shadow Training*

Shadow workouts, often known as shadow steps, are foot movements that reposition the body to facilitate players' hitting motions (Ihsan et al., 2024). Because there are numerous ways to practise the shadow exercise method, it can be used to train leg motions (Ishak et al., 2020). Badminton players are advised to perform shadow workouts since they can improve their balance, agility, and quickness (Babar et al., 2021). Practise taking shadow steps to the court's corners as part of the Shadow Exercise, which is a footstep action that helps players position their bodies to make hitting moves simpler (Pratama et al., 2024).

*Training using Rope Balls*

Even in the absence of a coach or opponent, a rope tennis ball, also known as a bottle, can be used for court tennis practice. Training against a wall is nearly identical to this (Agustiyanta, Hidayatullah et al., 2022). A string tennis ball is referred to by its initials, "Boteli," and it has free ball brand specifications as long as it is as good as the elastic rope's length, or about 4 metres. The rope tennis ball assist is a tennis ball with a hole punched in it, linked with an elastic rubber strap that is incredibly strong, and tied with a plastic base that is weighted to withstand the ball's speed. Efficiency and functionality are two advantages of using a string tennis ball for technical drills like Relly Groundstroke. Even in the absence of a coach or opponent, a rope tennis ball, also known as a bottle, can be used for court tennis practice. It is quite similar to training with a wall. The Rope Tennis Ball is different in that it employs a rope that is attached to the ball and has its other end fastened to a brick or other weighted object. The player stands directly at the end of the rope, close to the weight, and hits the ball from this position to use it. After striking the ground, the ball rebounds off the corner. The ball spins in the direction of the player when it reaches the conclusion. When the ball was returned, the player enjoyed being hit again right away. It is repeated until the desired outcome is achieved. It is anticipated that this ball will be used so that court tennis instruction can take place anywhere, even on calm, paved streets.

*Interval Training*

A form of cardiovascular exercise known as interval training is repeated high-intensity training during a brief training period (Parmar et al., 2021). The goal of this exercise is to enhance training intensity in a little amount of time by alternating short rest intervals with high-intensity exercise sessions (Szumilewicz & Santos-Rocha, 2022). Interval training, often known as interval training, is a kind of aerobic exercise that is frequently done at a high intensity for brief periods of time (Fennell & Hopker, 2021). To build strength and raise the exercise's intensity, training periods can be progressively followed by heavier training motions (Yin et al., 2024). An intense series of quick, high-intensity workouts alternated with simpler, slower activities is known as interval training (Yin et al., 2024). Another name for this workout is "Fartlek," which is Swedish for "speed play." Instead of requiring you to train constantly, Fartlek raises the intensity of your workouts so you can perform more exercises (Brondani et al., 2022). Interval training was designed in a more systematic manner to enhance physical fitness. Training intervals alternate between active and resting times.

*Exercise Frequency*

In many scenarios where individual players must acquire (or relearn) motor skills, time is a critical limitation (Schmidt, 2019). The frequency of the time restriction for skill training is this circumstance. To optimise the quantity of possible learning, the frequency must be controlled (Maxime et al., 2024). Instructors must be aware of the variables, or practice settings, that affect learning success in order to meet the needs of frequency and make adjustments to maximise learning (Chester et al., 2024). For individual tennis players, frequency is an important factor to take into account. Even with just two practice sessions per week, beginners can get better (Nair et al., 2024). One of the most important aspects of a training programme is rest; getting enough of it will boost output and lower the chance of injury (Murphy et al., 2022). A three-minute rest is given by players to replenish energy following a brief workout (e.g., 10 to 60 seconds of activity). When designing a training regimen based on the evolution of the energy system, players must take this into consideration. A player experiences exhaustion when they run as fast as they can for ninety seconds; this is known as metabolic fatigue, which affects the energy system, thus they need enough rest time to recover.

## Conclusions

After a thorough analysis, it was discovered that there is a relationship between physical performance and training methods and how well field tennis drive stroke skills are improved. Physical performance includes things like muscle strength, aerobic and anaerobic endurance, speed and acceleration, explosiveness, flexibility, agility, and balance. Training methods include circuit training, strength training, endurance training, kinesthetics' perception training, shadow sports training, rope ball.

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## Conflict of interest

The researcher states that there are no conflicts of interest in this work.

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# Оцінка впливу тренувальних методик та фізичної результативності на розвиток навичок з техніки виконання драйву в корт-тенісі: Огляд літератури

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 10 с., 2 табл., 1 рис., 94 джерел.

**Мета дослідження.** Метою дослідження було розробити програму тренувань та покращити показники фізичної результативності шляхом аналізу літературних джерел задля вдосконалення техніки виконання драйву (англ."Drive"— сильний і низький удар при відбиванні м'яча) в цьому різновиді тенісу.

**Матеріали та методи.** Проведено комплексний аналіз попередніх досліджень, що включає огляд статей, опублікованих у період з 2019 по 2024 роки, в яких обговорюються шляхи поліпшення фізичної підготовленості волейболістів. Електронний пошук проводився з використанням наукометричних баз даних SPORTDiscus, PubMed, Google Scholar, Web of Science та Scopus. На наступному етапі дослідження було зібрано наукові статті, в яких розглядаються найефективніші способи покращення навичок з техніки виконання драйву в корт-тенісі за допомогою фізичної результативності та застосуванню практичних тренувальних методик.

**Результати.** Згідно з результатами цього дослідження було встановлено, що в сорока статтях використовувалися методики розвитку фізичної результативності та практики з метою покращення техніки виконання драйву в корт-тенісі. На основі оцінок фізичного стану та його подальшого покращення, матеріали було класифіковано за категоріями. Анаеробна швидкісна витривалість визначалася як метод тренування, який може бути застосований спортсменом.

**Висновки.** Після проведення ретельного аналізу було зроблено наступні висновки: оскільки фізична результативність включає м'язову силу, аеробну та анаеробну витривалість, швидкість і прискорення, вибухову силу, гнучкість, спритність і рівновагу, низка тренувальних режимів виявилася ефективною з точки зору вдосконалення навичок з техніки виконання драйву в корт-тенісі. До таких тренувальних методів належать кругові тренування, силові тренування, тренування на витривалість, тренування на розвиток кінестетичного сприйняття, тренування, що спрямовані на вивчення і засвоєння технічних елементів (наприклад, ударів) без залучення реального партнера, тренування з мотузковим м'ячем, інтервальні тренування та частота тренувань.

**Ключові слова:** огляд літератури, режими фізичних вправ, фізичний стан, виконання драйву, корт-теніс.

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