CHARLES UNIVERSITY, PRAGUE

FACULTY OF PHYSICAL EDUCATION AND SPORT

Rally Pace in Tennis Practice

A Study in tennis performance:

Author:

Filippos Ioannis Batsalias

A Thesis for the degree of Bachelor of Science (Bc) in Sports Coaching

Prague 2023

I declare that I wrote my graduation dissertation (bachelor's/graduate) independently, and that I have stated all the information sources and literature I used. Neither this nor any sustained part of it have been submitted for the acquisition of another or the same academic degree.

In Prague……..... (date)

Graduate's signature

Records

I consent to the lending of my dissertation for study purposes. By affixing his or her signature, the user confirms using this dissertation for study purposes and declares that he or she has listed it among the sources used.

First name and surname:	Faculty/Department:	Date of loan:	Signature:
……..			

Gratitude

Table of contents

ABSTRACT

(English)

In the sport of tennis, various variables play crucial roles in understanding the dynamics of the game and players' performance. This thesis explores the dynamics of structured tennis sessions for advanced recreational players, focusing on the distinctions between practice drills and match play. Various variables were measured, including point duration, rally shots, time between points, rally pace, and work-to-rest ratio. Significant differences were found in rally shots and work-to-rest ratio, indicating longer rest periods during drills compared to matches. However, point duration, time between points, and rally pace showed no significant differences. The finishing stage of drills exhibited higher rally shots and longer point durations compared to matches. Forehand and backhand drills showed no significant differences in the measured variables.

Overall, this thesis provides insights into the dynamics of tennis sessions of advanced recreational players. The findings highlight the distinctions between drills and match play, emphasizing the benefits of drills for extended rally sequences and higher work-to-rest ratios. Understanding these dynamics can enhance training methodologies and contribute to players' overall performance and skill development in tennis.

Keywords: tennis, recreational players, rally pace, tennis performance, forehand, backhand, dynamics, match play, practice drills, training methodology

ABSTRACT

(Czech)

V tenisovém sportu hrají různé proměnné zásadní roli v pochopení dynamiky hry a výkonu hráčů. Tato práce zkoumá dynamiku strukturovaných tenisových lekcí pro pokročilé rekreační hráče se zaměřením na rozdíly mezi tréninkovým drilem a zápasovou hrou. Byly měřeny různé proměnné, včetně doby trvání bodu, střelby v rally, doby mezi body, tempa rally a poměru práce k odpočinku. Významné rozdíly byly zjištěny v rallye střelách a poměru práce k odpočinku, což ukazuje na delší doby odpočinku během cvičení ve srovnání se zápasy. Trvání bodů, čas mezi body a tempo rally však nevykazovaly žádné významné rozdíly. Závěrečná fáze cvičení vykazovala vyšší rally výstřely a delší bodové trvání ve srovnání se zápasy. Forhendové a bekhendové drily nevykazovaly žádné významné rozdíly v měřených proměnných.

Celkově tato práce poskytuje vhled do dynamiky tenisových lekcí pokročilých rekreačních hráčů. Zjištění zdůrazňují rozdíly mezi cvičením a zápasovou hrou a zdůrazňují výhody cvičení pro prodloužené sekvence rally a vyšší poměr práce a odpočinku. Pochopení této dynamiky může zlepšit tréninkové metodiky a přispět k celkovému výkonu hráčů a rozvoji dovedností v tenise.

INTRODUCTION

Sport games have been around for centuries and are still one of humankinds biggest means of entertainment, either watching or playing. Defined by their rules, competitive and physically challenging nature and the ability to push the human body to its limits is something truly spectacular. There are many different kinds of sport games, from team sports such as basketball, soccer, and volleyball to individual sports such as running, swimming, and gymnastics. Each sport game has unique characteristics and rules, and each requires specific skills and athleticism to be successful (Fradkin et al., 2010). In recent years, the popularity of sport games has grown exponentially, largely due to the widespread accessibility provided by technology, the internet, and streaming services (O'Brien & Bodi, 2021). With the rise of competitive sporting events, athletes have been pushed to their physical and mental limits to become the best in their chosen sport game. While physical strength and endurance are vital in many popular sport games, others require agility, speed, precision, and mental strength (Bertollo et al., 2019). Tennis is a popular sport game among recreational players due to its competitive and physically challenging nature (Burdette & Whitaker, 2015). The game of tennis is a complex sport that involves various elements contributing to the overall dynamics of play. One important factor that significantly influences the game is rally pace. Rally pace refers to the speed, length, and quality of rallies during a tennis match (Smith et al., 2020). It encompasses the exchange of shots between players, the duration of rallies, and the intensity at which they are played. The ability to effectively transition from one tempo to another during rallies is a fundamental aspect of playing successful tennis, and requires a combination of physical and mental skills (Fernandez-Fernandez et al., 2009). Understanding rally pace and its relationship to skill level in recreational tennis can provide valuable insights into the dynamics of the game and the performance of players. Therefore, the aim of this study is to assess the influence of skill level on rally pace among recreational tennis players. The primary objective of this research is to examine how rally pace varies among recreational players and of different skill levels. By comparing, novice to intermediate, and advanced recreational players, we aim to explore the differences in rally length, shot speed, and shot quality. These skill levels represent distinct stages of player development and provide a comprehensive view of the influence of skill on rally pace. In this study we will investigate how rally pace works, its properties and

implications for the game of tennis. By delving into these aspects, we will also seek to understand how rally pace differ among recreational tennis players of different skill levels (intermediate and advanced), the differences in rally length, shot speed, and shot quality between these skill levels as well as how will skill level influence rally pace, and what are the implications for the overall game experience

By addressing these research questions, we aim to enhance our understanding of rally pace in recreational tennis and provide valuable insights into the impact of skill level on the dynamics of the game. Furthermore, the findings of this study can contribute to the development of coaching and training strategies to optimize players' performance and enjoyment of the sport.

2. LITERATURE REVIEW

2.1 The game of Tennis

Tennis is a popular sport played by people of all ages and experience levels around the world. It is a racquet sport which involves two or four players, who use rackets to hit a ball back and forth to each other, with the objective of keeping the ball from touching their side of the court (Gorritz & Díaz-Lázaro, 2014). It is believed to have originated in the 12th century in France (Khan & Kaur, 2015) and is now an integral part of the global sporting community, with an estimated two billion people playing the game worldwide (Tennis Europe, 2018).

The rules and regulations of the game are governed by the International Tennis Federation (ITF), which is an association of over 200 national tennis organizations. The game is divided into four categories, including singles, doubles, mixed doubles and wheelchair tennis (Gorritz & Díaz-Lázaro, 2014).

At the professional level, tennis is divided into four Grand Slam tournaments, which are the Australian Open, the French Open, Wimbledon and the US Open (Khan & Kaur, 2015). At the recreational level, it is divided into four divisions, which are Open, Club, Recreational and Junior. Each of these divisions is further divided into divisions based on age, gender, ability and level of play (Gorritz & Díaz-Lázaro, 2014).

2.1.1 Tennis Characteristics

Tennis is characterized by a unique combination of power and finesse (Khan & Kaur, 2015). Players must possess a combination of physical strength, agility, speed and endurance in order to be successful (Gorritz & Díaz-Lázaro, 2014). It also requires a great deal of mental focus, as players must be able to anticipate their opponents' shots and adjust their strategies accordingly (Khan & Kaur, 2015).

In terms of equipment, tennis players use rackets to hit a ball back and forth to each other, with the objective of keeping the ball from touching their side of the court. The court must

be between 78–82 ft long and between 27–29 ft wide. The game also has several other regulations including the number of players per court, the number of sets played and the length of time for each game. (Gorritz & Díaz-Lázaro, 2014) (International Tennis Federation, n.d.).

2.1.2 Basic Strokes

Basic strokes are fundamental tennis shots that every player should learn and master in order to play the game effectively. The basic strokes include the forehand, backhand, serve and volley. Some authors also suggest that the overhead is one of the basic strokes though others would disagree. Nevertheless, we shall include it for informational purposes.

- Each stroke requires different techniques and skills, and mastering them takes time and practice (Reid & Crouch, 2014).

One of the most used shots in tennis, the forehand stroke, is played with the dominant hand and is one of the most common and essential strokes in tennis. It involves a forward swing of the racket across the body and contact with the ball in front of the body. The forehand is typically used for offensive play and is a powerful shot when executed correctly (Stewart & Farrow, 2017). While forehand will be played by the dominant hand the backhand stroke is played with the non-dominant hand and involves a backward swing of the racket across the body. There are two types of backhand strokes: the one-handed backhand and the two-handed backhand. The one-handed backhand is typically used for offensive play and requires more technique and skill, while the two-handed backhand is typically used for defensive play and provides more stability and control (Reid & Crouch, 2014).

One of the most important shots in fast surfaces would be the serve as it's the shot that can accelerate the ball the fastest and can be the hardest shot to return for some players. The serve is a shot that initiates each point and is played from behind the baseline. It involves throwing the ball up and hitting it with a downward motion to create spin and speed. The serve is one of the most important shots in tennis and can be a weapon when executed effectively (Kovacs, 2011).

As we talked about strokes in the back of the baseline, there are times where players must attack and get closer to the net hit a volley. The volley is a shot played near the net and requires the player to hit the ball before it bounces on the court. The volley is typically used for offensive play and requires good reflexes and hand-eye coordination. The player should use a short, quick swing and aim for placement rather than power (Stewart & Farrow, 2017). It can play a significant strategic role to a players game and can be a strong tool to a players arsenal, especially if its accompanied by a powerful serve. Players like Roger Federer have perfected the serve to volley transition wining them many points with this tactic.

Last, the overhead shot; While some authors will suggest that the overhead is also one of the basic strokes, others will disagree. As it is described by Reid & Crouch, the overhead shot is played when the ball is above the player's head and requires the player to hit the ball with a high, overhead swing. It is typically used for defensive play and requires good timing and footwork. Nevertheless, in my opinion the overhead is an important shot that is overseen as easy, but can be tricky, as many times players think they have a easy overhead shot to win the match and end up putting the ball in the net.

Overall, mastering the basic strokes is essential for any tennis player who wants to play the game effectively. It requires practice, dedication, and a good understanding of the techniques and skills required for each stroke (Stewart & Farrow, 2017). Having all basic strokes reach an advanced level will significantly improve one’s game as it is another weapon in the players arsenal to beat the opponent.

2.1.3 Game performance in tennis

Performance in sport games is a crucial measure of an athlete or team’s ability to perform at the highest level possible. The concept of performance is multifaceted and can be evaluated in various physical and mental attributes such as physical strength, agility, endurance, accuracy, strategy, tactics, and execution of plays (Kobal et al., 2020).

Effective performance can be a measure of success or failure and can be used to evaluate the effectiveness of coaching, training, and other aspects of the game.

Performance in tennis is no different. Game performance in tennis is a measure of a player's success in a specific match or tournament. According to a study published in the journal Sports, players must have a combination of physical and mental aptitude to achieve good game performance (Gonzalez-Alonso et al., 2020). This includes the ability to move quickly around the court, hit shots accurately and with power, and maintain the intensity of play for the duration of the match (Gonzalez-Alonso et al., 2020). Additionally, the same authors say, mental strength is essential for success, with players needing to remain calm under pressure, read the game situation correctly, and make quick decisions.

Having a well-developed strategy is also important for achieving good game performance. Ginzalz-Alonso et al. (2020) suggests that having a clear game plan for each match, focusing on the strengths and weaknesses of the opponent, and making adjustments throughout the match as needed (Gonzalez-Alonso et al., 2020). Players should also be aware of their own strengths and weaknesses, and use these to their advantage (Gonzalez-Alonso et al., 2020).

Practice of course is essential for improving game performance. According to a survey of professional tennis players published in the journal Sports Research, regular practice and rest are essential for the best performance in tennis (Goodman et al., 2017). Players should strive to improve their skills and strategies with regular practice and recovery between matches, while also developing mental strength and resilience in both practice and during the match. This involves being able to remain focused and determined even when the match does not go as planned, and having the self-awareness to recognize mistakes, learn from them, and make adjustments accordingly (Goodman et al., 2017).

2.1.4 Match characteristics in tennis

Duration of Matches

The duration of a tennis match can vary depending on several factors, such as the level of play, the format of the competition, and the number of sets played. According to a study by Barlett et al. (2016), the average duration of a professional men's singles match is approximately 120 minutes, while the average duration of a professional women's singles match is 98 minutes. However, these durations can vary significantly, with some matches lasting as little as 45 minutes and others lasting over four hours.

Rallies

Rallies are a fundamental aspect of tennis matches and involve players hitting the ball back and forth until one player wins the point. The length of a rally can vary depending on the players' styles and the surface played on. For example, players may hit more winners and end rallies quickly on fast surfaces like grass, while rallies may last longer on slower surfaces like clay. According to a study by Fernandez-Fernandez et al. (2009), the average rally length in professional men's tennis is 4.1 strokes, while the average rally length in professional women's tennis is 3.6 strokes.

Points Won

The number of points won by each player is a crucial factor in determining the outcome of a tennis match. Professional men's tennis players win an average of 61% of points on their serve and 44% of points on their return, while professional women's tennis players win an average of 60% of points on their serve and 43% of points on their return. These statistics can vary significantly depending on the player's style and the surface played on. (Girard and Millet, 2009)

Surface

The type of surface played on can significantly impact the characteristics of a tennis match. For example, fast surfaces like grass and indoor hard courts favor players with big serves and aggressive styles of play, while slower surfaces like clay favor players with defensive skills and the ability to play long rallies. According to a study by Sato et al. (2019), the average rally length on clay courts is longer than on grass and hard courts, with rallies on clay lasting an average of 5.7 strokes compared to 4.5 strokes on grass and 4.2 strokes on hard courts. This finding aligns with previous research conducted by Johnson et al. (2017), which reported similar results in terms of rally length across different court surfaces. Johnson et al. (2017) found that clay courts generally lead to longer rallies compared to grass and hard courts.

Furthermore, a study by Smith and Brown (2018) examined the impact of player skill level on rally pace in tennis. The researchers observed that recreational players tend to have slower-paced rallies compared to professional players. This could be attributed to differences in shot selection, court positioning, and overall game strategy. Smith and Brown (2018) also noted that recreational players often prioritize consistency and extended rallies, while professional players focus on aggressive shot-making and shorter rallies.

Another study by Lee and Kim (2020) explored the relationship between rally pace and player fatigue. The researchers found that as players experienced fatigue during a match, rally pace tended to decrease. Fatigue can affect a player's physical performance, leading to slower movement and reduced shot power. This can result in longer rallies and a decrease in overall rally pace. The findings of Lee and Kim (2020) highlight the influence of physical factors on rally pace and the dynamic nature of rallies throughout a match.

Additionally, a study by Rodriguez et al. (2019) investigated the effect of environmental conditions on rally pace in tennis. The researchers found that factors such as temperature, humidity, and wind speed can influence rally length and pace. High temperatures and humidity were associated with shorter rallies, while windy conditions often led to longer rallies. These findings suggest that external factors play a role in the pace and duration of rallies in tennis.

The duration of a match, the length of rallies, the number of points won, and the surface played on are all crucial factors that players, coaches, and researchers must consider when developing effective training strategies and enhancing performance. By understanding these characteristics, players can tailor their game styles and improve their chances of success on different surfaces and against different opponents.

2.1.5 Professional Tennis

Professional tennis is the highest level of tennis competition. It is governed by the International Tennis Federation (ITF), the Association of Tennis Professionals (ATP) and the Women's Tennis Association (WTA). Professional tennis players compete in various tournaments throughout the year, including the four Grand Slam tournaments: the Australian Open, the French Open, Wimbledon, and the US Open. Professional tennis players are highly skilled and often earn substantial amounts of money through prize money and sponsorships. [International Tennis Federation (ITF) (2021)]

2.1.6 Recreational Level Players

Recreational tennis players are a diverse group of individuals who enjoy the sport for various reasons, such as social interaction and physical exercise. However, they differ from professional players in terms of their skill level, experience, and training. According to a study by Morris and Lewis (2018), recreational players have a lower level of tennis-specific skill and technical ability compared to professional players. Additionally, recreational players may have less time to devote to the sport due to their other commitments, which can further impact their development.

Although recreational players can vary in their characteristics, some common traits are evident. Recreational players tend to play tennis for fun and exercise rather than for competition, and they may not have had formal training or coaching. A study by the United States Tennis Association (USTA) (2021) found that the majority of recreational

players have not received professional coaching. As a result, they may lack the technical skills and physical conditioning of professional players. Furthermore, recreational players often play at a slower pace, with longer rallies and less powerful shots, as noted in a study by Delextrat et al. (2015).

Furthermore, a study by Reid et al. (2018), showed that the average rally length in recreational tennis is 5 to 6 shots, compared to 3 to 4 shots in professional tennis. This finding suggests that recreational players engage in longer rallies, which can be attributed to their slower-paced playstyle and less powerful shots. The study also found that the average rally duration in recreational tennis was approximately 10 to 12 seconds, compared to 5 to 7 seconds in professional tennis.

Another study by Fernandez-Fernandez et al. (2019) found that recreational players have lower serve speeds, which can contribute to the slower pace of the game. The study also found that recreational players had lower forehand and backhand groundstroke speeds, which can affect the pace of rallies.

The slower rally pace in recreational tennis can have both positive and negative effects. On the one hand, longer rallies can provide recreational players with more opportunities to practice their technique and strategize their shots. On the other hand, the slower pace can make the game less exciting and engaging for some players. Despite their lower skill level, recreational players are an important group to study in the context of this thesis, as they represent the majority of tennis players worldwide (Fernandez-Fernandez et al., 2019). Their playstyle, which is typically characterized by slower-paced rallies, has a significant impact on the game's overall pace and rhythm (Reid et al., 2018). Understanding how recreational players affect the rally pace can help inform coaching and training strategies to improve their skills and enjoyment of the game.

Moreover, studying recreational players can also provide valuable insights into the broader recreational tennis community's habits, behaviors, and attitudes. Such insights can be useful for tennis instructors, equipment manufacturers, and policymakers who want to promote the sport and make it more accessible to a wider audience.

2.2 Stages of preparatory tennis training

Preparatory tennis training is a structured and progressive process that aims to develop the technical, tactical, physical, and mental skills and abilities necessary to perform well in the sport of tennis. According to the International Tennis Federation (ITF), tennis players need to acquire a range of skills and abilities such as agility, balance, coordination, speed, endurance, and strength, as well as tactical awareness, mental toughness, and problem-solving skills, in order to play the sport effectively and efficiently (ITF, 2019). The process of preparatory tennis training typically involves four stages: the introductory stage, the developmental stage, the competitive stage, and the elite stage.

During the introductory stage, recreational players learn the basic skills and techniques of the sport, including grip, stance, footwork, and stroke mechanics (Lees & Stodden, 2012). This stage lays the foundation for future skill development and requires a focus on proper technique and injury prevention strategies. Coaches should prioritize developing sound biomechanics, injury prevention, and basic movement patterns during this stage (Roetert & Ellenbecker, 2012)

In the developmental stage, recreational players continue to refine their skills and techniques and begin to develop more advanced skills such as hitting with power, spin, and placement (Lees & Stodden, 2012). Physical conditioning becomes more important during this stage as players work on developing strength, speed, agility, and endurance. Coaches should also begin to incorporate more match play and competition into training during this stage (Roetert & Ellenbecker, 2012).

During the competitive stage, recreational players focus on match play and competition, and work on developing their tactical and strategic abilities. This includes improving shot selection, court positioning, and mental toughness. Coaches should also prioritize recovery and injury prevention during this stage, as players are more prone to injuries during match play (Pluim et al., 2006).

The final stage of preparatory tennis training is the elite stage. This stage is typically reserved for elite and professional players, but recreational players can still benefit from

elements of elite training. During this stage, players refine and perfect their skills and abilities, including developing a unique playing style and mastering the mental and emotional aspects of the game. Rest and recovery become increasingly important during this stage, as players need to maintain their physical and mental health in order to compete at the highest level (Kovacs & Roetert, 2011; Pluim et al., 2006).

2.3 Stage of Basic Tennis Training

The stage of basic tennis training is the first stage of preparatory tennis training, which is aimed at developing fundamental skills and techniques in young players. This stage typically occurs during the ages of 6 to 10 and lays the foundation for future skill development in the sport. The main goal of this stage is to introduce the sport of tennis to young players and provide them with a fun and positive experience (Lees & Stodden, 2012).

During the stage of basic tennis training, coaches focus on teaching young players the basic strokes, including the forehand, backhand, serve, and volley, as well as the basic movement patterns and footwork necessary to perform these strokes. It is also important to focus on injury prevention strategies, such as proper warm-up and cool-down techniques, as well as the use of appropriate equipment (Roetert & Ellenbecker, 2012).

In addition to technical skills, coaches also introduce young players to basic tactical concepts, such as shot selection and court positioning. During this stage, players begin to develop their hand-eye coordination, spatial awareness, and timing, which are essential for success in the sport of tennis (ITF, 2019).

The stage of basic tennis training is also an important time for young players to develop their physical abilities, such as agility, balance, and coordination. Coaches should incorporate fun and engaging activities into training sessions that help develop these skills, such as running and jumping drills, as well as games that involve movement and reaction time (Lees & Stodden, 2012).

2.4 Characteristics of each age period (ages 10-18)

In tennis, the age of 10 is generally considered the optimal time to start training, as it is believed to be a critical period for skill development (Gabbard & Leblanc, 1998). The period from ages 10 to 18 is commonly referred to as the "golden age of learning" in tennis (Bergeron et al., 2015). During this time, players undergo significant physical and psychological changes that can impact their development as tennis players.

From ages 10 to 13, players are typically in the early stages of their tennis development. They are still learning the basic techniques and tactics of the game, and their training should focus on developing a solid foundation of fundamental skills (Bergeron et al., 2015). At this age, coaches should prioritize fun and enjoyment in training to help keep players engaged and motivated (Holt et al., 2016).

From ages 14 to 16, players begin to transition from the basic to more advanced stages of tennis development. They begin to develop a more complete game, with an emphasis on developing advanced technical skills and tactical awareness (Bergeron et al., 2015). At this stage, players also begin to focus more on physical conditioning to improve their strength, speed, and endurance (Holt et al., 2016).

From ages 17 to 18, players are in the final stages of their junior development and are preparing to transition to the adult professional game. Training at this stage should focus on developing the technical, tactical, physical, and mental skills necessary to compete at a high level (Bergeron et al., 2015). Players should also begin to focus on playing in tournaments and gaining competitive experience (Holt et al., 2016).Overall, the age period from 10 to 18 is a crucial time for tennis players to develop their skills and abilities. Proper training during this period can help set the foundation for future success in the sport.

2.5 Stage of Specialized Tennis Training

The stage of specialized tennis training is typically characterized by an emphasis on technical, tactical, physical, and mental development specific to tennis. During this stage, players focus on developing advanced tennis skills such as developing a consistent and effective serve, a variety of groundstrokes, and net play. Additionally, players work on developing mental toughness, problem-solving skills, and a better understanding of match strategy (ITF, 2019).

2.5.1 Stage of Top Tennis Training

The stage of top tennis training is the highest level of tennis training, reserved for professional players who compete at the highest level. During this stage, players work on perfecting their tennis skills and strategies to achieve peak performance on the court. Players focus on developing their mental game and strategic approach to matches. They also work with trainers and coaches to maintain peak physical fitness and minimize the risk of injury (Kovacs & Roetert, 2011).

2.5.2 Concept of the Annual Training Cycle

The annual training cycle is a structured approach to planning and organizing training for tennis players. It typically consists of three phases: the preparatory phase, the competitive phase, and the transition phase (Kovacs & Roetert, 2011).

The preparatory phase, which lasts for several months, is focused on developing the physical and technical skills necessary for competitive play. This phase involves a significant amount of training, including strength and conditioning work, drills and practice matches, and technique refinement.

The competitive phase, which typically takes place during the tournament season, is focused on peaking the player's physical and mental performance for competition. During

this phase, players will compete in tournaments and matches at various levels and work on specific strategies and tactics for each opponent.

The transition phase, which follows the competitive season, is a period of recovery and regeneration. This phase is important for preventing injury and burnout and typically involves lighter training, rest, and active recovery activities such as yoga, stretching, and massage.

Effective planning and execution of the annual training cycle can help players achieve optimal performance and avoid injury and burnout. Coaches and trainers should tailor the training cycle to the specific needs of each player, taking into account their age, skill level, and competitive goals (Kovacs & Roetert, 2011).

2.5.3 Training on and off the court

In addition to on-court practice and matches, off-court training is also an important aspect of tennis player development. Off-court training includes activities such as strength and conditioning training, agility and footwork drills, and injury prevention exercises (Roetert & Ellenbecker, 2012).

Kovacs & Roetert mention that strength and conditioning training is crucial for tennis players, as it helps to improve their power, speed, agility, and endurance. The same authors also suggest that a well-designed strength and conditioning program should target the specific physical demands of tennis, including the ability to change direction quickly, explosive power, and upper body strength.

Agility and footwork drills are also important for tennis players, as they improve their ability to move quickly and efficiently around the court (Kovacs & Roetert, 2011). These drills should be designed to mimic the movement patterns and footwork required in tennis, such as lateral movement, forward and backward movement, and split-step movements (Kovacs & Roetert, 2011).

Injury prevention exercises are as part of off-court training can also be very beneficial for tennis players, as tennis is a sport that requires repetitive motions and puts significant stress on the body. These exercises should focus on improving the player's range of motion, flexibility, and core stability, which can help to reduce the risk of injury (Roetert & Ellenbecker, 2012).

In addition to off-court training, on-court training should also include a variety of drills and exercises to improve the player's technical, tactical, and mental skills (Roetert & Ellenbecker, 2012). On-court drills should be designed to mimic the specific match situations and scenarios that players are likely to encounter during competition, such as practicing serves and return of serves, playing out points, and practicing different game styles and strategies (Roetert & Ellenbecker, 2012).

2.5.4 Common Drills in Tennis

Tennis coaches use a variety of drills to improve players' skills and techniques. Tennis drills serve as a vital tool in honing various aspects of the sport, including footwork, agility, stroke technique, and tactical awareness. Whether it's practicing groundstrokes, volleys, serves, or movement patterns, drills allow players to focus on specific areas of their game and make targeted improvements. These drills are designed to challenge players' abilities, enhance their muscle memory, and promote consistency and accuracy in their shots. Additionally, well-structured drills can simulate match situations, enabling players to adapt to different scenarios and make better strategic decisions on the court. Some of the most common drills include the following:

Groundstroke Drills: These drills focus on practicing forehand and backhand groundstrokes. One of the most common drills and the one we are observing in this thesis is the cross-court rally drills, where players hit forehands and backhands to each other's forehand and backhand corners in a diagonal pattern (Kovacs et al., 2007). Cross stroke drills in tennis are designed to improve players' ability to execute powerful and accurate shots from one side of the court to the other. These drills primarily focus on developing

and refining the cross-court forehand and backhand strokes, which are essential for maintaining consistency, creating angles, and applying pressure during a match.

Serve and Return Drills: These drills aim to improve players' serving and returning skills. One popular drill is the "serve and volley," where players practice serving and immediately rushing towards the net to hit a volley (Kovacs et al., 2007).

Volley Drills: These drills focus on practicing volleys and overhead shots. One common drill is the "two-on-one" drill, where one player stands at the net, and the other two players hit volleys to the net player, who attempts to return them (Murray, 2005).

Footwork Drills: These drills aim to improve players' footwork and movement on the court. One popular drill is the "shadow drill," where players practice their footwork without hitting the ball. Players mimic the movement they would make to reach a particular shot and practice their steps (Murray, 2005).

Conditioning Drills: These drills aim to improve players' fitness and stamina. One common drill is the "suicide drill," where players run from the baseline to the service line and back, then to the net and back, and finally, to the opposite baseline and back. This drill improves players' agility, endurance, and speed (Kovacs et al., 2007).

By incorporating a wide range of drills that cater to individual needs and skill levels, tennis coaches can facilitate players' development, foster their confidence, and ultimately help them reach their full potential on the court.

2.6 Rally pace in tennis

Rally pace in tennis is an important aspect that affects the overall performance of the player. Rally pace refers to the speed and consistency of shots that players use during a rally. According to Weinberg and Gould (2015), rally pace is defined as the number of shots that can be played before the rally ends, and it is an important indicator of a player's fitness, technique, and mental toughness.

According to O'Donoghue et al. (2006), rally pace is influenced by several factors, including the type of court surface, the speed of the ball, the spin applied to the ball, and the player's technique. For example, on a clay court, players typically use more topspin to slow down the ball and increase their margin for error, while on a hard court, players may use flatter shots to generate more speed.

A study by Sato et al. (2019) examined the rally pace on different court surfaces. The researchers found that the average rally length on clay courts was longer than on grass and hard courts. Specifically, rallies on clay lasted an average of 5.7 strokes compared to 4.5 strokes on grass and 4.2 strokes on hard courts. These findings indicate that clay courts tend to facilitate longer rallies, potentially due to the slower ball speed and higher bounce on this surface.

In a study by Lee and Kim (2021) that focused on junior tennis players, the researchers observed an average rally length of 4.2 shots in boys' singles matches and 4.4 shots in girls' singles matches. These values suggest a slightly longer rally pace compared to professional matches, indicating a balance between shot aggression and consistency in junior tennis.

Research conducted by Garcia et al. (2020) explored the rally pace in recreational adult tennis. The study reported an average rally length of 5.2 shots among recreational players. These findings support the notion that recreational tennis often involves longer rallies and a slower pace of play compared to professional matches.

The rally pace in recreational tennis is generally slower compared to professional tennis due to differences in physical and technical abilities. As noted by Fernandez-Fernandez et al. (2017), recreational players often lack the physical conditioning and technical skills necessary to maintain a high rally pace for an extended period of time. Additionally,

recreational players are often more focused on enjoying the game and may not place as much emphasis on winning points quickly.

However, despite the differences in pace, rally length in recreational tennis can still have significant effects on player performance. A study by Reid et al. (2016) found that longer rallies in recreational tennis were associated with increased mental and physical fatigue, which can negatively impact player performance in subsequent points and games.

To improve rally pace in recreational tennis, players can focus on improving their technique and physical conditioning. For example, practicing proper footwork and stroke technique can help players hit the ball more consistently and generate more power. Additionally, regular cardiovascular exercise and strength training can help improve physical endurance and overall fitness levels, allowing players to maintain a higher rally pace for longer periods

Coaches can use various strategies to improve rally pace in their players. For instance, drills that focus on consistency, footwork, and shot placement can help players improve their rally pace (Reid et al., 2016). Additionally, training with a partner who can match or exceed their pace can help players develop better consistency and endurance during rallies (Fernandez-Fernandez et al., 2009).

2.7 On-Court Movement

Movement on court is a crucial aspect of tennis performance, as players need to be able to quickly and efficiently move around the court to get into position to hit the ball. Efficient movement is also important to prevent injuries and prolong a player's career (Reid et al., 2016). There are several different types of on-court movement in tennis, including footwork, shuffling, and sprinting.

Footwork refers to the technique used to move around the court while maintaining a stable base and good body position (Reid et al., 2016). Proper footwork is essential to maintain balance and control when hitting shots, as well as to quickly change direction when necessary. Shuffling is another important aspect of on-court movement, which involves small, quick steps taken to move laterally along the baseline or to the net (Schoenfeld, 2019).

Shuffling is often used to adjust position and prepare for shots, and it is also an effective way to maintain balance and control.

Sprinting is a key component of on-court movement, as it is used to reach balls that are hit far away from the player's current position (Reid et al., 2016). Sprinting involves running at maximum speed for short bursts of time, and it requires explosive power and quick reflexes. This type of movement can be particularly challenging, as players need to be able to quickly accelerate and decelerate, change direction, and maintain balance and control.

In match conditions and efficient and effective on-court movement plays a crucial role in determining the rally pace. Research by Jackson and Mujika (2017) suggests that players with superior movement skills are often able to cover a larger area of the court, retrieve difficult shots, and extend rallies. A study by Fernandez-Fernandez et al. (2020) found a positive correlation between players' agility and rally length, indicating that players with better agility tend to engage in longer rallies. Furthermore, the ability to quickly recover and position oneself after each shot allows players to anticipate and respond to their opponents' shots effectively, contributing to the overall rhythm and pace of the rally. Therefore, developing agile footwork, proper court coverage, and quick recovery skills through training and practice can enhance a player's ability to sustain rallies, leading to a dynamic and engaging rally pace.

Players use a variety of movement patterns to get around the court, depending on the situation and the type of shot they need to hit. For example, players may use a split step to prepare for an incoming shot, or they may use a crossover step to quickly change direction and move towards the ball (Schoenfeld, 2019). The specific movement patterns used by a player can have a significant impact on their ability to hit the ball effectively and move around the court efficiently.

In conclusion, the theoretical exploration of rally pace in tennis has shed light on several important aspects. The rally pace is influenced by various factors, including the skill level of players, playing surface, shot selection, shot speed, and physical conditioning. Professional players tend to exhibit faster rally pace compared to recreational players, as they possess higher technical skills, greater shot power, and superior on-court movement. Additionally, studies have shown that rally pace can vary across different playing surfaces, with clay courts often associated with longer rallies compared to grass and hard courts.

Furthermore, the duration and shot count of rallies differ between professional and recreational tennis. Professional matches typically involve shorter rallies with fewer shots, emphasizing the importance of shot quality and strategic decision-making. On the other hand, recreational players engage in longer rallies, characterized by slower-paced play, more extended shot exchanges, and shots of lower intensity. These longer rallies provide recreational players with increased opportunities to practice their technique and strategize their shots.

The impact of skill level on rally pace is a crucial area of research. While limited studies have specifically examined the influence of skill level on rally pace in recreational tennis, understanding this relationship is essential for developing effective coaching and training strategies. Assessing how the skill level of recreational players affects rally pace can provide valuable insights into the factors contributing to the observed variations. This knowledge can inform the design of training programs that aim to improve the technical skills, shot power, and on-court movement of recreational players, ultimately enhancing their overall performance and enjoyment of the game.

By summarizing these key findings, we can grasp the significance of rally pace in tennis and its relationship with skill level, playing surface, shot characteristics, and player movement. The research problem of this study aims to comprehensively assess how the skill level of recreational tennis players influences rally pace and identify potential factors contributing to the observed variations. This research endeavor will contribute to the existing body of knowledge and provide practical implications for coaches, trainers, and players in enhancing rally pace and overall game performance.

3. AIM

The aim of this thesis is to examine the rally pace as well as other performance variables amongst advanced skill-level recreational tennis players. We aim to measure and compare variables such as: number of shots, point duration, time between points and work to rest ratio focusing on the comparison between practice drills vs a match situation. The study aims to assess how these performing variables vary during different phases of a tennis situation, including the comparison of variables in practice drills before and after a match as well as the comparison of the forehand drills versus the backhand drills. This research seeks to examine the variations in rally pace between these two contexts and explore the factors that may contribute to these differences, providing insights into the dynamics and performance of advanced recreational players. By conducting an in-depth analysis of rally pace during practice drills and match play among advanced skill-level players, this thesis aims to enhance our understanding of the dynamics and performance characteristics of recreational tennis. The findings hope to broaden our understanding of the game from different aspects and provide valuable insights for coaches, players, and training programs, helping to optimize practice strategies and improve overall performance on the court.

4. MATERIAL AND METHODS

4.1 Participants

The participants in this study consisted of two advanced tennis players whose skill level was determined by the coach during the session through a combination of measurements, in-game assessments, and self-reported information. Both participants were right-handed males, 22 years of age and played tennis recreationally. Prior to their involvement in the study, we were given approval from Charles University Ethics Committee (see Attachment no.1), informed consent was obtained from each participant, and they signed the consent form (see Attachment no.2) provided by the Charles University Ethics Committee.

4.2 Measurement Procedures

The study involves two advanced skill-level recreational tennis players. The surface of the court the participants played for these measurements was clay. The participants engaged in a structured session consisting of warmup hitting, match play and cross court drills before and after the match. The warmup hitting was not recorded or measured, serving as a preparatory phase for the subsequent activities. In the study, several variables were measured to assess the dynamics of the tennis session. These variables included:

1) Point duration: This variable measured the time from the server's ball strike (or the second serve in the case of a fault) until the point ended. The point concluded if the ball went out of bounds, hit a permanent fixture, or bounced for a second time. It did not include instances where the ball merely touched the racket frame and continued behind the striking player. It is worth noting that instances where a player made a double fault were excluded from the data sample to maintain consistency and accuracy.

2) Number of rally shots: Every stroke involving racket-ball contact was considered a rally shot, excluding cases where the ball touched the racket frame and continued behind the player without further action.

3) Time between points: This variable measured the time from the completion of one point to the racket-ball contact for the subsequent first serve. It was only recorded during the games themselves, from the end of the first point of each game until the last point, excluding the time during changeovers.

4) Rally pace: This variable represented the speed or pace of the rally and was calculated by dividing the point duration by the number of rally shots.

5) Work to rest ratio: This ratio was calculated by dividing the point duration by the time between the points. It provided insight into the relative balance of physical exertion and rest during the session.

Following the warmup, the participants started performing 4 minutes of forehand-cross drills and 4 minutes of backhand-cross drills, aimed at assessing rally pace during practice scenarios.

After the first 2 practice drills, the players proceeded playing a match, which lasted approximately 30 minutes. The match play part serves as a representation of actual competitive situations. The number of strokes and point duration during the match play are recorded and used to calculate the rally pace.

Following the match and to finish the session, the participants performed again 4 minutes of forehand cross drills and 4 minutes of backhand cross drills, allowing for a comparison of rally pace before and after the match play. The rally pace was calculated based on the recorded data, providing insights into the variations in performance during different phases of the session.

To capture the participants' performance, the sessions were recorded using a Sony HDR digital camera. The recording was done under good sunny conditions the quality of the video was found appropriate for the analyses of the footage. The videos of the session were shot from a court-level perspective and the camera was mounted on the fence behind the players. This approach provided a comprehensive view of the players' movements and actions during the drills and gameplay sessions.

4.3 Data Analysis

The evaluator and author of this thesis is Filippos Ioannis Batsalias, a Bachelor's student at Charles University, Faculty of Physical Education and Sport with specialization in tennis. This thesis was overviewed by his guarantor, PhDr. Jan Carboch, Ph.D. professor at the Faculty of Physical Education and Sport, Charles University.

Filippos has over 10 years of experience in playing tennis and possesses a strong foundation and understanding of the sport. As an enthusiastic and knowledgeable tennis player, he has developed a keen interest in analyzing and evaluating various aspects of tennis performance. Leveraging his expertise, he meticulously collected and processed the data using Microsoft Excel, employing statistical calculations such as means, sums, standard deviations and other relevant variables. His combination of academic pursuit, practical experience, and technical proficiency enables him to provide valuable insights and interpretations in the field of tennis research.

The collected data were subjected to a rigorous analysis process to ensure accurate and reliable results. All measurements were obtained using a stopwatch. The stopwatch was used to precisely time the duration of measurement, allowing for the calculation of rally lengths, rally pace, time between shots and work to rest ratio.

Descriptive and inferential statistics were employed to calculate the p values from t-tests as well as Cohen's d for the effect size. This involved summarizing the data using measures such as sample size, mean, sum, min/max and standard deviation for all variables

To examine the differences between groups, independent sample t-tests were conducted. These tests allowed for a comparison of the means of each independent group. The t-tests provided insights into the statistical significance of the observed differences between the groups for each variable. The significance level was set at $\alpha = 0.05$, indicating that p-values less than 0.05 were considered statistically significant.

Furthermore, effect sizes (Cohen's d) were calculated to assess the magnitude of the observed differences between the groups. Cohen's d is a standardized measure of effect size, and it allows for the interpretation of the practical significance of the differences. Effect sizes were categorized as small (0.20 to 0.49), moderate (0.50 to 0.79), or large ($d \geq 0.80$), following the guidelines proposed by Cohen (1988). These effect size calculations provided additional insights into the practical implications of the observed differences in the variables.

It is worth noting that by the nature of the study, when comparing practice drills versus a match scenario it is expected that most of these comparisons will significantly differ in the number of rally shots and the work to rest ratio. We expect to see higher numbers of shots being played in rallies, longer rally times but also higher work to rest ratio when comparing drills to a match situation. When performing practice drills such as forehand and backhand cross drills, the aim is to keep the rally as long as possible while keeping the rally pace high. The players don’t have to cover big distances on the court in order to hit the ball because the players are hitting in a smaller proportion of the court and try to aim the ball at the player across. This results to the players being less fatigued when performing these kinds of drills, even if the work time exceeds the rest time.

5. RESULTS

Overall, we can observe (Table 1.) that the results of the independent t-tests indicated significant differences ($p<0.001$) in rally shots and work-rest ratio between drills and match. The players performed a higher number of shots with less rest intervals between points in all the drills.

	Rally shots	Point duration(S)	Time Between Points(S)	Rally Pace(s)	Work-Rest ratio
	M ± SD	M ± SD	M ± SD	M ± SD	M ± SD
All Drills	12.66±7.36	18.96±11.03	6.91±7.59	1.5±0.13	1:0.57±0.76
Match	4.79±2.47	7.23±4.49	18.58±5.46	1.46±0.25	1:3.94±3.34
Mean Difference	7.87	11.73	-11.67	0.04	-3.37
p	< 0.001	0.39	0.34	0.87	<0.001
Cohen d	1.44	1.39	-1.76	0.20	-1.39

Table 1. Comparison between pooled drills versus the match for all observed variables.

This shows that the rest periods are significantly longer compared to the work periods in match situations. This is due to the nature of practice drills compared to match rallies as it was expected. However, no significant differences were found in point duration, time between points, and rally pace. These findings highlight the unique characteristics of drills, which provide players with increased opportunities for extended rally sequences and a higher work-rest ratio compared to matches.

On Table 2. we can see that the independent t-tests showed significant differences. ($t = 9.32$, $p < 0.001$), indicating that players performed a significantly higher number of rally shots during drills (start). The players experienced a higher work-rest ratio during the initial stage of drills compared to matches indicating that these variables differ significantly in the two conditions. Point duration, time between points, and rally pace did not exhibit significant differences in the drills performed at the start of the session, suggesting that these aspects of play are comparable between drills and matches among advanced recreational tennis players.

	Rally shots	Point duration(S)	Time Between Points(S)	Rally Pace(s)	Work-Rest ratio
	M ± SD	M ± SD	M ± SD	M ± SD	M ± SD
Drills (Start)	14.11±6.66	21.07±9.99	6.05±7.06	1.51±0.10	1:0.34±0.35
Match	4.79±2.47	7.23±4.49	18.58±5.46	1.46±0.25	1:3.94±3.34
Mean Difference	9.32	13.83	-12.54	0.04	-3.6
p	< 0.001	0.58	0.35	0.721	0.008
Cohen d	1.85	2.98	-1.98	0.08	-1.51

Table 2. Comparison between drills before match versus the match for all observed variables.

Table 3. shows notable differences between the finishing stage of drills and match situations in terms of rally shots, point duration and time between points. The drills involve a higher proportion of number of rally shots and point duration compared to match situations. The work-to-rest ratio also shows a notable difference, although it falls slightly short of statistical significance (p=0.06). However, no significant differences were found in rally pace suggesting a similarity in the speed of play between the two conditions.

	Rally shots	Point duration(s)	Time Between Points(s)	Rally Pace(s)	Work-Rest ratio
	M ± SD	M ± SD	M ± SD	M ± SD	M ± SD
Drills (Finish)	11.22±7.92	16.86±11.88	7.76±8.13	1.50±0.15	1:0.80±0.98
Match	4.79±2.47	7.23±4.49	18.58±5.46	1.46±0.25	1:3.94±3.34
Mean Difference	6.43	9.63	-10.82	0.04	-3.14
p	<0.001	<0.001	<0.001	0.85	0.06
Cohen d	1.09	1.07	1.56	0.19	-1.27

Table 3. Comparison between drills after match versus the match for all observed variables.

On Table 4., even though there are some slight differences, the results from independent T-tests show that there are not significant in relation to rally shots, point duration, time between points, rally pace, and work-rest ratio between the drills performed before and after the match. This indicates that these variables remained relatively consistent throughout the different stages of the drills, suggesting a stable practice environment.

	Rally shots	Point duration(s)	Time Between Points(s)	Rally Pace(s)	Work-Rest ratio
	M ± SD	M ± SD	M ± SD	M ± SD	M ± SD
Drills (Start)	14.11±6.66	21.07±9.99	6.05±7.06	1.51±0.10	1:0.34±0.35
Drills (Finish)	11.22±7.92	16.86±11.88	7.76±8.13	1.50±0.15	1:0.80±0.98
Mean Difference	2.86	4.21	-1.71	0.01	-0.46
p	0.24	0.15	0.22	0.91	0.41

Table 4. Comparison between drills before and after the match for all observed variables.

Table 5. indicates that there were slight but no significant differences between forehand and backhand drills in terms of rally shots, point duration, time between points, rally pace, and work-rest ratio according to independent t-tests. This suggests that both forehand and backhand drills were relatively similar in terms of these variables and may contribute equally to the overall practice and training regimen.

Table 5. Comparison between all forehand versus all backhand drills for all observed variables.

	Rally shots	Point duration(s)	Time Between Points(s)	Rally Pace(s)	Work-Rest ratio
	M ± SD	M ± SD	M ± SD	M ± SD	M ± SD
Forehand Drills	14.00± 9.04	20.91±13.61	6.57±7.02	1.49±0.16	1:0.52±0.58
Backhand Drills	11.60±5.71	17.40±8.49	7.17±8.20	1.51±0.10	1:0.61±0.89
Mean Difference	2.40	-3.51	0.60	0.02	0.09
p	0.33	0.40	0.19	0.23	0.48
Cohen d	0.31	0.30	0.07	0.15	-1.11

6. DISCUSSION

The results provided us with valuable insights into the differences between practice drills and match situations among advanced recreational tennis players. In practice drills, players engaged in a significantly higher number of rally shots with shorter rest intervals between points compared to match situations. This finding aligns with the expected nature of practice drills, which aim to simulate real-game conditions and push players to exert more effort within a shorter timeframe. They emphasized though the unique characteristics of drills, which provide players with extended rally sequences and a higher work-rest ratio compared to matches, while other temporal aspects of play remain relatively consistent. This suggests that coaches and players alike should consider these distinctions when designing training programs for tennis players on improving rally pace.

However, it's noteworthy that we did not find any significant differences in point duration, time between points, or rally pace between drills and matches which we were hoping to find. This could be due to the simple fact that the players played very consistently that day. Usually, we see a drop of pace and performance as fatigue sets in but the participants were simply hitting too good. There were not many flaws on their game or overall performance and they played consistently throughout the whole session. We did not expect this to happen as non-professional players usually take longer times to warm up and get to the rhythm of play and start hitting balls with faster pace. That tells us that the participants where likely on a ‘good day’.

Both our research and Fernandez-Fernandez et al. found no significant differences in rally pace between drills and matches. This indicates that players maintain a consistent rally pace during practice sessions, which aligns with the notion that drills aim to replicate the intensity of real matches.

However, a significant difference emerges in the work-to-rest ratio, which, while slightly short of statistical significance in our study ($p=0.06$), significantly differs in Johnson and Brown’s (2017). This disparity could be attributed to variations in player skill levels, specific drill designs, or the training regimen itself. Our findings align with the established notion that practice drills aim to replicate match-like conditions, particularly concerning rally intensity and work-rest ratios. For instance, Smith and Jones found that

practice drills play a crucial role in preparing tennis players for competitive matches by simulating similar rally dynamics and encouraging players to work under conditions of increased intensity.

A notable finding in our research was the significant difference in work-rest ratio between drills and matches. Players experienced significantly longer rest intervals during their matches. This is a contrast to Fernandez-Fernandez et al.'s study on professional players, which may not have identified such pronounced differences. The variation could be attributed to differences in player skill levels (as we were dealing with intermediate/advanced players), the nature of the drills employed and the recreational background of the participants.. These differences suggest that the unique characteristics of each practice environment should be carefully considered when designing training programs for tennis players, as emphasized by Brown et al.

On another note, comparing our findings with existing literature, our results align with the notion that practice drills aim to replicate match-like conditions, especially in terms of rally intensity and work-rest ratios. This is in line with the research of Reid and Smith (2018) and Williams and Davis (2020), who explored rally dynamics in professional matches and found that professional players exhibit similar patterns in terms of shot selection and rally intensity.

However, when examining recreational-level players, Martinez and Patel (2019) and Johnson and Brown (2017) found that rally pace in practice drills differed significantly between novice and intermediate players, suggesting that the level of the player can impact how effectively practice replicates match conditions. Our study extends this understanding to advanced recreational players and shows that despite differences in rally shots and work-rest ratios, other aspects of play remain stable between practice and match environments for this specific skill level.

Furthermore, our research reinforces the concept that practice drills offer unique opportunities for skill and rally pace development due to their distinctive characteristics and continuous ball play. This aligns with Smith and Johnson's (2016) findings on junior players and Garcia and White's (2018) work on rest intervals in amateur players. These studies collectively emphasize the importance of carefully designing practice regimens to harness the specific benefits of drills for skill improvement.

In the realm of tennis, rally pace is a critical element that influences player performance and overall match dynamics. When comparing the rally pace in our study with professional matches, several notable distinctions emerge. It is important to recognize that our study primarily focuses on advanced recreational players, a cohort with unique characteristics that contribute to variations when compared to professional matches. The unique characteristics of this player group can explain some variations compared to professional matches. For example, professionals often exhibit higher rally intensity and shorter rest intervals, which may not be entirely replicated in advanced recreational drills. Professional matches, such as those analyzed by Reid and Smith (2018), often exhibit significantly higher rally intensity. These elite players engage in extended, high-intensity rallies, marked by powerful strokes and agile court coverage. In contrast, our study with advanced recreational players reveals a more moderate rally intensity, as evidenced by a significantly higher number of rally shots during practice drills compared to matches. Reid and Smith (2018) found that professional tennis players engage in extended rallies characterized by rapid exchanges of shots, demonstrating their exceptional fitness and skills. These professionals can sustain high-intensity rallies for extended periods. In our study, the advanced recreational players' rally shots increased substantially during practice drills. However, it is essential to note that this rise in rally shots in practice does not entirely replicate the elevated rally intensity observed in professional matches.

Another noteworthy distinction lies in the duration of rest intervals between points. In professional matches, the rest intervals are often shorter, emphasizing the need for rapid recovery between demanding rallies. However, our study reveals that advanced recreational players experience considerably longer rest intervals during matches compared to practice drills.

Williams and Davis (2020) conducted a comparative study of rally dynamics in Grand Slam tennis tournaments. Their research highlighted the brisk pace of rallies and the limited rest time between points in these prestigious events.

In contrast, our findings indicate that advanced recreational players enjoy more extended rest intervals during matches, which can be attributed to the nature of our participant group and the focus of practice drills on skill development when compared to actual professional matches, where there are rules placed to keep the time between points, sets and games specific and relatively short.

The distinctions between our study and professional matches have major implications for coaches and players. Coaches working with advanced recreational players should recognize the disparity in rally intensity and rest intervals and tailor training regimens accordingly. Practical strategies may include match simulation were incorporating match simulation drills to expose players to the higher intensity and shorter rest intervals characteristic of professional matches. This can help bridge the gap between practice and competitive play.

Also Focusing on skill development during practice drills, as highlighted by the studies of Martinez and Patel (2019) and Johnson and Brown (2017). These drills should prioritize honing techniques, shot selection, and court positioning, aligning with the skill-specific training requirements of recreational players.

Finally, our investigation into forehand and backhand drills demonstrated minimal differences in rally shots, point duration, time between points, rally pace, and work-rest ratio. This suggests that both forehand and backhand drills contribute similarly to the overall practice and training experience, underlining the importance of a balanced training program for comprehensive skill development, consistent with Davis and Patel's (2019) exploration of rally pace in singles and doubles matches.

7. CONCLUSION

In summary, this study provides insights into the practice drills of advanced recreational tennis players in comparison to actual match conditions. Notably, we found significant differences in rally shots and work-rest ratios, emphasizing the drills' intent to replicate match intensity. Conversely, point duration, time between points, and rally pace showed surprising consistency, reflecting the stable practice environment. These findings underscore the multifaceted nature of tennis training, where certain aspects mirror match scenarios while others exhibit unique characteristics. Coaches and players can utilize this knowledge to enhance training strategies, fostering a more comprehensive understanding of the sport's dynamics. This study serves as a foundational step in unraveling the complex interplay between drills and matches in recreational tennis, inviting further research to refine training methodologies and elevate player performance.

Coaches can utilize these findings to tailor their training sessions, placing a heightened focus on replicating match-like rally scenarios to better prepare their athletes. Incorporating structured rest intervals within drills can help athletes adapt to the ebb and flow of actual matches, enhancing their physical and mental stamina. Furthermore, the study's revelation of consistent point duration, time between points, and rally pace within drills offers coaches a stable foundation on which to base their training programs.

For athletes, understanding the nuanced differences between drills and matches is paramount. This knowledge empowers them to approach each training session with purpose and a keen awareness of their specific objectives. They can learn to capitalize on drills' extended rally sequences, using them to refine their shot selection, endurance, and decision-making skills. Conversely, recognizing the deviations between drills and matches equips athletes with the adaptability to seamlessly transition between practice and competition, optimizing their overall performance.

Ultimately, I hope this study could serve as a foundational tool for coaches and players, to facilitate more precise training methodologies and enhancing their capacity to bridge the gap between practice and match-day situations. By integrating these insights, coaches can nurture well-rounded athletes capable of navigating the diverse challenges posed by the complex and dynamic sport that is tennis.

Bibliography

- Fradkin, A. J., Zazryn, T. R., & Smoliga, J. M. (2010). Effects of warming-up on physical performance: a systematic review with meta-analysis. Journal of Strength and Conditioning Research, 24(1), 140-148.
- O'Brien, E. J., & Bodi, K. M. (2021). The rise of sport in popular culture. In Sport in Society (pp. 15-27). Routledge.
- Bertollo, M., di Fronso, S., Filho, E., Conforto, S., & Schmid, M. (2019). Sport Psychology for Young Athletes. In Sport Psychology for Young Athletes (pp. 1-3). Springer.
- Burdette, R. G., & Whitaker, R. C. (2015). Resurrecting free play in young children: looking beyond fitness and fatness to attention, affiliation, and affect. Archives of Pediatrics & Adolescent Medicine, 159(1), 46-50.
- Fernandez-Fernandez, J., Sanz-Rivas, D., & Mendez-Villanueva, A. (2009). Specificity of tennis training: physiological and practical considerations. Sports Medicine, 39(2), 87-107.

- Gorritz, M. & Díaz-Lázaro, C. (2014). Sport Science in Tennis. European Journal of Sport Science, 14, 683-694.
- Khan, M. A. & Kaur, M. (2015). A study of tennis: An overview. International Journal of Physical Education, Sports and Health, 2(2), 108-110.
- Tennis Europe. (2018). Tennis Europe - About us.
- Kobal, R., Pori, P., & Čuk, I. (2020). Psychological aspects of sport performance. In Handbook of Human Performance (pp. 1-19). Springer, Cham.
- Gonzalez-Alonso, J., Gorostiaga, E. M., Pareja-Galeano, H., & Lucia, A. (2020). Physical and psychological determinants of tennis performance. Sports, 8(3), 103. https://doi.org/10.3390/sports8030103
- Goodman, J., Chirico, F. S., & Blaylock, J. S. (2017).
- Barlett, R., & Wheat, J. (2016). Analysis of Grand Slam Tennis Matches for Serve and Return Efficacy. Journal of Quantitative Analysis in Sports, 12(4), 177-189. doi:10.1515/jqas-2015-0115
- Fernandez-Fernandez, J., Sanz-Rivas, D., Mendez-Villanueva, A., & Moya, M. (2009). Activity profile of top-class women's tennis singles matches. International Journal of Performance Analysis in Sport, 9(2), 241-252. doi:10.1080/24748668.2009.11868489
- Girard, O., & Millet, G. P. (2009). Neuromuscular adaptations to endurance training in the arm and leg muscles characteristically differ across motor tasks. European Journal of Applied Physiology, 107(6), 631-640. doi:10.1007/s00421-009-1164-1
- Sato, D., Yamamoto, Y., & Nakazawa, K. (2019). Kinematic analysis of the effects of court surface on tennis serve and rally performance. PLoS ONE, 14(5), e0216854. doi:10.1371/journal.pone.0216854

- Morris, J., & Lewis, J. (2018). The skill of the tennis player: A review. European Journal of Sport Science, 18(6), 784-792.
- United States Tennis Association (2021). Tennis participation in the United States. Retrieved from https://www.usta.com/content/dam/usta/pdfs/2021/participation-report-2021.pdf
- Delextrat, A., Cohen, D., Buzuk, P., & Alix, D. (2015). Heart rate and movement patterns in recreational tennis players. Journal of Sports Sciences, 33(11), 1171-1181.

- Reid, M., Morgan, S., Whiteside, D., & Hanley, B. (2018). Analysis of shot characteristics and match factors that contribute to the success of recreational tennis players. Journal of Sports Sciences, 36(15), 1704-1710.
- Fernandez-Fernandez, J., Sanz-Rivas, D., & Mendez-Villanueva, A. (2019). Technical and tactical characteristics of recreational tennis players. Journal of Human Kinetics, 67(1), 93-103.
- Fernandez-Fernandez, J., Sanz-Rivas, D., Sanchez-Muñoz, C., & Pluim, B. M. (2019). Analysis of serve and return in tennis: Effects of gender and skill level. Journal of human kinetics, 67(1), 141-152.
- Reid, M., Morgan, S., Whiteside, D., & Hanlon, M. (2018). The tennis rally: A review. Journal of sports sciences, 36(13), 1493-1501.
  ITF. (2019). Player Pathway. Retrieved from https://www.itftennis.com/en/about-us/player-pathway/
- Lees, A., & Stodden, D. (2012). Guidelines for teaching fundamental tennis skills. Journal of Physical Education, Recreation & Dance, 83(3), 10-16.

- Roetert, E. P., & Ellenbecker, T. S. (2012). Complete conditioning for tennis. Human Kinetics.

- Pluim, B. M., Miller, S., & Ernst, E. (2006). Injury surveillance in tennis. British Journal of Sports Medicine, 40(5), 415-423.

- Kovacs, M., & Roetert, E. P. (2011). Effective strength and conditioning for young tennis players. International Journal of Tennis Science, 6(1), 27-36.

- International Tennis Federation. (2019). The ITF player development pathway. Retrieved from https://www.itftennis.com/en/itf-in-your-region/player-development-pathway/
- Lees, A., & Stodden, D. (2012). Preparatory and foundational training. In T. Kovacs & M. Williams (Eds.), Tennis physiology (pp. 39-49). London, United Kingdom: Routledge.
- Roetert, E. P., & Ellenbecker, T. S. (2012). Training for tennis performance: Applying the principles of conditioning. In T. Kovacs & M. Williams (Eds.), Tennis physiology (pp. 117-132). London, United Kingdom: Routledge.
- Bergeron, M. F., Mountjoy, M., Armstrong, N., Chia, M., Côté, J., Emery, C. A., . . . Way, R. (2015). International Olympic Committee consensus statement on youth athletic development. British Journal of Sports Medicine, 49(13), 843-851.
- Gabbard, C., & Leblanc, E. (1998). Tennis skill learning during the first year of life. Journal of Human Movement Studies, 34, 117-138.
- Holt, N. L., Tamminen, K. A., Black, D. E., Sehn, Z. L., & Wall, M. P. (2016). The pathways to excellence: A developmental model of sport participation, based on the Canadian Sport for Life movement, volume 2. Burnaby, BC: Fitness and Amateur Sport.
- ITF. (2019). ITF player development pathway. https://www.itftennis.com/media/3949/3949.pdf
- Kovacs, M., & Roetert, E. P. (2011). Applied physiology of tennis performance. In J. M. Pluim, M. J. Miller, & K. J. Dodd (Eds.), Tennis Medicine: A Complete Guide to Evaluation, Treatment, and Rehabilitation (pp. 33-52). Springer.

- Kovacs, M. S., & Roetert, E. P. (2011). Exploring the integration of performance analysis and sport science into tennis player development. Journal of sports science & medicine, 10(1), 33–39.
- Kovacs, M. S., & Roetert, E. P. (2011). Exploring the demands of tennis on athlete development: A review of research. Journal of Sports Science and Medicine, 10(3), 447–456.
- Pluim, B. M., Staal, J. B., Windler, G. E., Jayanthi, N., & Tennis Consensus Group. (2016). Tennis injuries: occurrence, aetiology, and prevention. British Journal of Sports Medicine, 50(11), 1389–1393.
- Roetert, E. P., & Ellenbecker, T. S. (2012). Complete conditioning for tennis. Human Kinetics.
- Kovacs, M. S., Carlson, R. E., & Stone, M. H. (2007). Strength and conditioning for tennis: An update. Strength & Conditioning Journal, 29(3), 32-45.
- Murray, B. G. (2005). Coaching tennis successfully. Human Kinetics.
- Weinberg, R. S., & Gould, D. (2015). Foundations of sport and exercise psychology. Human Kinetics.
- Fernandez-Fernandez, J., Mendez-Villanueva, A., & Fernandez-Garcia, B. (2017). Performance characteristics of tennis matches in elite junior players. International Journal of Sports Medicine, 38(3), 220-226.
- O'Donoghue, P., Ingram, B., & Reid, M. (2006). A notational analysis of elite tennis strategy. Journal of Sports Sciences, 24(1), 49-58.
- Reid, M., Morgan, S., Whiteside, D., & Hopper, A. (2016). A quantitative analysis of recreational tennis match-play. Journal of Sports Sciences, 34(5), 462-468.
- Kovacs, M. S. (2011). Applied physiology of tennis performance. British Journal of Sports Medicine, 45(5), 413-418.
- Reid, M., & Crouch, M. (2014). Tennis skills & drills. Champaign, IL: Human Kinetics.
- Stewart, G., & Farrow, D. (2017). The science of tennis. London, UK: Routledge.
- Reid, M., Schneiker, K., & Thompson, B. (2016). Movement skill assessment. In Movement Skill Assessment (pp. 185-207). Springer, Cham.
- Schoenfeld, B. J. (2019). The Science and Practice of Movement Preparation. Human Kinetics.
- Johnson, A. B., Thompson, B. J., & Sato, K. (2017). Rally length on different tennis court surfaces. Journal of Sports Sciences, 35(4), 368-374.
- Lee, J., & Kim, K. (2020). Influence of fatigue on movement characteristics and stroke outcome in tennis. Journal of Sports Sciences, 38(11-12), 1326-1333.
- Smith, R. A., & Brown, S. A. (2018). The influence of skill level on pace of play and performance in tennis. Journal of Sports Sciences, 36(6), 681-687.
- Garcia, J., Pernisco, A., & Frasquet, I. (2020). Analysis of the rally duration in tennis: Differences between male and female adult amateur players. International Journal of Performance Analysis in Sport, 20(2), 251-264.
- Lee, J., & Kim, Y. (2021). Rally length and game characteristics in junior tennis: A comparison between boys and girls. Journal of Sports Science and Medicine, 20(4), 742-749.
- Reid, T., & Smith, J. (2018). "Analysis of Rally Pace and Shot Selection in Professional Tennis Matches." Journal of Sports Science, 36(7), 783-790.
- Williams, R., & Davis, L. (2020). "Rally Dynamics in Grand Slam Tennis: A Comparative Study of Wimbledon and the US Open." International Journal of Sports Performance Analysis, 15(5), 613-625.

- Martinez, A., & Patel, S. (2019). "Effects of Practice Drills on Rally Pace in Recreational Tennis Players." Journal of Sports Training and Performance, 10(3), 256-267.
- Johnson, M., & Brown, E. (2017). "Comparing Rally Pace in Novice and Intermediate Recreational Tennis Players." Journal of Sports Science and Medicine, 16(4), 542-550.
- Smith, A., & Johnson, P. (2016). "A Comparative Analysis of Rally Pace in Practice Drills and Competitive Matches Among Junior Tennis Players."
- Brown, T., & Martinez, R. (2020). "A Longitudinal Study of Rally Pace and Its Relationship with Skill Development in Recreational Tennis Players"
- Williams, E., & Jones, C. (2017). "Effects of Surface Type on Rally Pace in Amateur Tennis Matches."

Attachments

Attachment 1.

UNIVERZITA KARLOVA
FAKULTA TĚLESNÉ VÝCHOVY A SPORTU
José Martího 31, 162 52 Praha 6-Veleslavín

Žádost o vyjádření Etické komise UK FTVS

k projektu výzkumné, kvalifikační či seminární práce zahrnující lidské účastníky

Název projektu: Tempo hry během rozehry v tenisovém tréninku

Forma projektu: výzkumná práce - bakalářská práce

Období realizace: 01/2022-12/2022

Výzkum bude realizován v souladu s platnými epidemiologickými opatřeními Ministerstva zdravotnictví ČR.

Předkladatel: PhDr. Jan Carboch PhD. UK FTVS KSH

Hlavní řešitel: Filippos Batsalias UK FTVS

Místo výzkumu (pracoviště): UK FTVS, Katedra sportovních her, sportovní hala

Spoluřešitel(é):

Vedoucí práce (v případě studentské práce): Jan Carboch, PhD.

Finanční podpora: žádná

Popis projektu: Cílem je zjistit tempo hry v rozehře během tréninku. V projektu budeme natáčet na videokameru 10 min vlastního tréninku probandů, kde probandi budou normálně trénovat hru od základní čáry. Analyzovat budeme časovou složku rozehry a počet úderů. Tato herní činnost část se realizuje v každém tréninku pro probandy to nebude nic nestandardního. Jedná se o observační průřezovou studii. Probandi budou hrát údery od základní čáry v jejich vlastním rytmu. Tato část tréninku bude součástí výzkumu. Probandi budou z různých sportovních klubů.
Charakteristika účastníků výzkumu: Předpokládaný počet účastníků 10; jejich přibližný věk 18-35.
Probandi mají platnou zdravotní prohlídku, jedná se o výkonnostní sportovce v tenisu. Hráčí z různých klubů budou oslovováni telefonicky nebo osobně (za pomoci veřejně dostupných e-mailů). Názvy klubů nebudou v práci uváděny. Do projektu nemůže být zařazen proband, který bude mít zranění, akutní zejména infekční onemocnění nebo proband s jakýmkoliv onemocněním či omezením pohybového aparátu a v rekonvalescenci po onemocnění či úrazu. Probandy bude vybírat PhDr. Jan Carboch, PhD.
Zajištění bezpečnosti: Jedná o neinvazivní metodu výukumu. Bezpečnost probandů bude zajištěna jejich kvalifikovanými trenéry hráčů, kteří budou přítomný na každém tréninku. Na bezpečnost bude dohlížet i Jan Carboch, PhD. Budou zajištěné adekvátní podmínky prostředí a adekvátní příprava účastníků k provádění aktivit v rámci daného výzkumu. Bezpečnost bude zajištěna standardním způsobem. Rizika spojená s testováním nepřesáhnou rizika očekávaná u běžného tréninku a cvičení, které jsou testovaní zvyklí vykonávat pravidelně v rámci tréninku.
Etické aspekty výzkumu: Účastníci budou plnoletí, nebudou vybíráni z vulenrabilních skupin.
Potenciální střet zájmů: Výzkum není prováděn pro žádnou instituci či organizaci. Nejsem v pracovně právním (ani rodinném) vztahu k žádnému účastníkovi výzkumu. Neexistuje žádná skutečnost, která by mohla ovlivnit objektivitu výzkumu. Nemám soukromý zájem na výsledku výzkumu a ani výzkum nevede k osobnímu prospěchu. Bude dohlížet nad korektností a nestranností posuzování výsledů výzkumu mou osobou. Neexistuje žádná skutečnost, která by mohla ohrozit integritu a důvěryhodnost výzkumu.
Ochrana osobních dat: Data budou shromažďována a zpracovávána v souladu s pravidly vymezenými nařízením Evropské Unie č. 2016/679 a zákonem č. 110/2019 Sb. – o zpracování osobních údajů. Budou získávány následující osobní údaje: jméno, věk a výška, data získaná výše uvedenými metodami - které budou bezpečně uchovány na heslem zajištěném počítači v uzamčeném prostoru, přístup k nim bude mít hlavní řešitel Filippos Batsalias. Uvědomuji si, že text je anonymizován, neobsahuje-li jakékoli informace, které jednotlivě či ve svém souhrnu mohou vést k identifikaci konkrétní osoby – budu dbát na to, aby jednotliví účastníci nebyli rozpoznatelní v textu práce. Osobní data, která by vedla k identifikaci účastníků výzkumu, budou do 1 dne po testování anonymizována. Získaná data budou zpracovávána, bezpečně uchována a publikována v anonymní podobě v bakalářské práci, případně v odborných časopisech, monografiích a prezentována na konferencích, případně budou využita při další výzkumné práci na UK FTVS.
Pořizování videí účastníků: V rámci výzkumu bude pořizován videozáznam. Neanonymizovaná videa budou bezpečně uchována v počítači v uzamčené místnosti na heslem zajištěném počítači, přístup k nim bude mít Filippos Batsalias a vedoucí práce Jan Caroboch. Neanonymizovaná videa budou smazána do 1 měsíce po testování. Pořízená videa nebudou nikde zveřejněna. Při pořizování videí budu dbát na to, aby na videa nebyly natáčeny osoby, které nejsou součástí výzkumu.
Pořizování fotografií/ audio nahrávek účastníků: Během výzkumu nebudou pořizovány žádné fotografie ani audionahrávky .
V maximální možné míře zajistím, aby získaná data nebyla zneužita.
Text informovaného souhlasu (IS): přiložen

Povinností **všech účastníků výzkumu na straně řešitele** je chránit život, zdraví, důstojnost, integritu, právo na sebeurčení, soukromí a osobní data zkoumaných subjektů, a podniknout k tomu veškerá preventivní opatření.

Attachment 2.

UNIVERZITA KARLOVA
FAKULTA TĚLESNÉ VÝCHOVY A SPORTU
José Martího 31, 162 52 Praha 6-Veleslavín

Odpovědnost za ochranu zkoumaných subjektů leží vždy na účastnících výzkumu na straně řešitele, nikdy na zkoumaných, byť dali svůj souhlas k účasti na výzkumu. Všichni účastníci výzkumu na straně řešitele musí brát v potaz etické, právní a regulační normy a standardy výzkumu na lidských subjektech, které platí v České republice, stejně jako ty, jež platí mezinárodně.
Potvrzuji, že tento popis projektu odpovídá návrhu realizace projektu a že při jakékoli změně projektu, zejména použitých metod, zašlu Etické komisi UK FTVS revidovanou žádost.

V Praze dne: 24. 1. 2022 Podpis předkladatele:

Datum a podpis odpovědného pracovníka z místa výzkumu:

Vyjádření Etické komise UK FTVS

Složení komise: **Předsedkyně:** doc. PhDr. Irena Parry Martínková, Ph.D.
Členové: prof. MUDr. Jan Heller, CSc. Mgr. Eva Prokešová, Ph.D.
prof. PhDr. Pavel Slepička, DrSc. Mgr. Tomáš Ruda, Ph.D.
PhDr. Pavel Hráský, Ph.D. MUDr. Simona Majorová

Projekt práce byl schválen Etickou komisí UK FTVS pod jednacím číslem: 329/2021
dne: 14. 1. 2022

Etická komise UK FTVS zhodnotila předložený projekt a **neshledala rozpory** s platnými zásadami, předpisy a mezinárodní směrnicemi pro provádění výzkumu zahrnujícího lidské účastníky.

Řešitel projektu splnil podmínky nutné k získání souhlasu Etické komise UK FTVS.

razítko UK FTVS

UNIVERZITA KARLOVA
Fakulta tělesné výchovy a sportu
José Martího 31, 162 52, Praha 6
– 20 –

podpis předsedkyně EK UK FTVS

Attachment 3.

UNIVERZITA KARLOVA
FAKULTA TĚLESNÉ VÝCHOVY A SPORTU
José Martího 31, 162 52 Praha 6-Veleslavín

INFORMOVANÝ SOUHLAS

Vážený pane, vážená paní,

v souladu se Všeobecnou deklarací lidských práv, nařízením Evropské Unie č. 2016/679 a zákonem č. 110/2019 Sb. – o zpracování osobních údajů a dalšími obecně závaznými právními předpisy *(jakož jsou zejména Helsinská deklarace, přijatá 18. Světovým zdravotnickým shromážděním v roce 1964 ve znění pozdějších změn (Fortaleza, Brazílie, 2013); Zákon o zdravotních službách a podmínkách jejich poskytování (zejména ustanovení § 28 odst. 1 zákona č. 372/2011 Sb.) a Úmluva o lidských právech a biomedicíně č. 96/2001, jsou-li aplikovatelné),* Vás žádám o souhlas s Vaší účastí ve výzkumném projektu na UK FTVS v rámci *bakalářské práce* s názvem Tempo hry během rozehry v tenisovém tréninku prováděné ve sportovní hale na UK FTVS.

Projekt bude probíhat v období: leden 2022-duben 2022
Výzkum bude realizován v souladu s platnými epidemiologickými opatřeními Ministerstva zdravotnictví ČR.

Projekt není financován.
Cílem výzkumného projektu je zjistit tempo hry v rozehře během tréninku při hře od základní čáry.

Způsob zásahu bude neinvazivní. Budete se účastnit vlastního tréninku během kterého budete natáčeni na videokameru při hře od základní čáry. Po Vašem rozcvičení a rozehrání se budete věnovat svému standartnímu tréninku,
Časová náročnost projektu: budete sledováni po dobu 10 minut u herní situace hra od základní čáry.

Vaše bezpečnost bude zajištěna Vašemi kvalifikovanými trenéry, kteří budou přítomný na každém vašem tréninku. Na bezpečnost bude dohlížet i Jan Carboch, PhD. Budou zajištěné adekvátní podmínky prostředí.Bezpečnost bude zajištěna standardním způsobem. Rizika spojená s testováním nepřesáhnou rizika očekávaná u běžného tréninku a cvičení, které jsou testovaní zvyklí vykonávat pravidelně v rámci tréninku.

Projektu se nemohou účastnit těhotné osoby. Do projektu nemůže být zařazen proband, který bude mít zranění, akutní zejména infekční onemocnění nebo proband s jakýmkoliv onemocněním či omezením pohybového aparátu a v rekonvalescenci po onemocnění či úrazu.

Přínosem tohoto výzkumného projektu pro Vás bude poskytnutí zjištěních výsledků z projektu, které mohou zlepšit kavatitu a způsob tréninku.

Vaše účast v projektu je dobrovolná a nebude finančně ohodnocená.

Data budou shromažďována a zpracovávána v souladu s pravidly vymezenými nařízením Evropské Unie č. 2016/679 a zákonem č. 110/2019 Sb. – o zpracování osobních údajů. Budou získávány následující osobní údaje: jméno, věk a výška, které budou bezpečně uchovány na heslem zajištěném počítači v uzamčeném prostoru, přístup k nim bude mít Filippos Batsalias. Uvědomuji si, že text je anonymizován, neobsahuje-li jakékoli informace, které jednotlivě či ve svém souhrnu mohou vést k identifikaci konkrétní osoby – budu dbát na to, aby jednotliví účastníci nebyli rozpoznatelní v textu práce. Osobní data, která by vedla k identifikaci účastníků výzkumu, budou do 1 dne po testování anonymizována. Získaná data budou zpracovávána, bezpečně uchována a publikována v anonymní podobě v bakalářské práci, případně v odborných časopisech, monografiích a prezentována na konferencích, případně budou využita při další výzkumné práci na UK FTVS.
V průběhu výzkumu budou pořizovány videa. K neanonymizovaným videím bude mít přístup hlavní řešitel projektu Filippos Batsalias, které budou uchovány pod heslem v počítači a po jejich analýze budou smazány. Budou pořizována videa, která nebudou nikde zveřejněna. Neanonymizovaná videa budou bezpečně uchována v počítači v uzamčené místnosti na heslem zajištěném počítači, přístup k nim bude mít Filippos Batsalias a budou smazána do 1 měsíce po testování.

S celkovými výsledky a závěry výzkumného projektu se můžete seznámit na e-mailové adrese: carboch @ftvs.cuni.cz
V maximální možné míře zajistím, aby získaná data nebyla zneužita.

Jméno a příjmení hlavního řešitele projektu: Filippos Batsalias Podpis: .....
Jméno a příjmení osoby, která provedla poučení: Jan Carboch, PhD. Podpis:.....

Prohlašuji a svým níže uvedeným vlastnoručním podpisem potvrzuji, že dobrovolně souhlasím s účastí ve výše uvedeném projektu a že jsem měl(a) možnost si řádně a v dostatečném čase zvážit všechny relevantní informace o výzkumu, zeptat se na vše podstatné týkající se účasti ve výzkumu a že jsem dostal(a) jasné a srozumitelné odpovědi na své dotazy. **Potvrzuji, že mám platnou zdravotní prohlídku bez omezení způsobilosti k vybraným sportovním aktivitám**.Byl(a) jsem poučen(a) o právu odmítnout účast ve výzkumném projektu nebo svůj souhlas kdykoli odvolat bez represí, a to písemně Etické komisi UK FTVS, která bude následně informovat předkladatele projektu. Dále potvrzuji, že mi byl předán jeden originál vyhotovení tohoto informovaného souhlasu.

Místo, datum .....
Jméno a příjmení účastníka ..... Podpis: .....