

# Effect of different tennis court surfaces on the balance performance of tennis players

Elif Taşkuyu<sup>1ABCDE</sup>, Sedat Özcan<sup>2BC</sup>

<sup>1</sup>Faculty of Sports Sciences, Akdeniz University, Turkey

<sup>2</sup>Faculty of Sports Sciences, University of Süleyman Demirel, Turkey

Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

## Abstract

**Background and Study Aim** Tennis is a high-paced sport that demands significant physical capabilities, including balance, which is crucial for maintaining stability and control during play. The surface on which tennis is played, such as hard or clay courts, can impact these performance aspects differently. This study aimed to investigate the effects of playing tennis on hard and clay courts on the dynamic and static balance performances of novice male tennis players (university students).

**Material and Methods** Fifteen novice male tennis players (age:  $22.80 \pm 1.33$  years, height:  $178.67 \pm 7.30$  cm, body weight:  $73.00 \pm 6.88$  kg, body mass index:  $22.88 \pm 0.01\%$ ) participated in the study. The participants were randomly assigned to either a clay court or a hard court for the first testing session. The study employed a crossover design. Each testing session included dynamic (eyes open) and static (eyes closed) balance measurements. These were assessed using the Biodex Balance System (BBS) under both conditions. Measurements were conducted 15 minutes after the completion of a 1-hour standard tennis training session on each court surface. The entire study protocol was repeated three days after the first session, with the court surfaces reversed.

**Results** No significant differences were found in dynamic and static balance performances between the hard and clay courts. However, the static anterior-posterior stability index (APSI) on the clay court showed a significant difference ( $p = 0.035$ ) in favor of dynamic balance.

**Conclusions** Dynamic balance on the clay court was generally superior to static balance, especially in the APSI parameter. The study findings suggest that the type of court surface does not significantly impact balance performance, with the exception of anterior-posterior balance on clay courts. These results highlight the potential importance of training on various surfaces to optimize balance and overall performance in tennis.

**Keywords:** balance, clay court, hard court, tennis

## Introduction

Modern tennis is defined by high speed, powerful strokes, intense rotational movements, and rapidly evolving tactics. Players must anticipate opponents' actions, adjust strategies quickly, and maintain consistent strokes. These skills are now essential for success. Among the physiological and neuromuscular factors contributing to performance, balance is a critical component influencing overall playing quality [1].

Tennis court surfaces significantly influence player performance. Clay courts, with higher friction and rebound, cause the ball to bounce higher and slower, giving players more time to prepare [2]. This can extend rallies and increase physical demands. In contrast, hard courts produce faster ball speeds. They require quicker decisions and a more aggressive style of play [3, 4]. These surface variations not only affect movement and physical load but may also influence postural control and balance, especially during dynamic play.

Balance is the ability to keep the body's center of gravity within its base of support while minimizing sway [5]. Static balance refers to stability in a fixed position. Dynamic balance involves maintaining control while moving or shifting positions [6, 7]. Balance relies on input from the visual, vestibular, and somatosensory systems [8]. In fast-paced sports like tennis, dynamic balance is especially important for body control, joint stability, and coordinated movements [9, 10].

Research has also identified the ankle joint as a central component in maintaining dynamic balance [7]. Improved dynamic balance has been linked to better footwork precision, controlled movement, and enhanced joint stabilization. It allows players to react effectively and consistently during rallies [11]. It also plays a key role in critical game actions such as rapid direction changes, sudden stops, and accelerations [12].

While previous studies have examined how court surfaces affect movement patterns, speed, and physiological responses [3, 4], fewer have focused on their influence on balance. Starbuck et al. [13] suggested that clay courts may improve stability

due to higher friction. Similarly, Marigold and Patla [14] noted that surface compliance and traction can directly influence postural control strategies during movement.

Acute changes in static and dynamic balance following surface-specific play in tennis remain underexplored, particularly among novice players. This gap limits the ability to optimize training and preparation strategies based on short-term balance responses. It is hypothesized that clay court surfaces may positively influence balance performance due to increased proprioceptive and neuromuscular demands. The aim of this study is to investigate the immediate effects of playing tennis on clay and hard courts in relation to balance performance in novice players.

## Materials and Methods

### Participants

This study included fifteen novice male tennis players (university students) as participants. Novice players may respond differently to surface changes due to limited neuromuscular adaptation. This makes them a valuable group for understanding early-stage balance mechanisms. This justification supports the selection of a novice population and enhances the originality of the study by exploring a less-studied group in the context of surface-specific balance performance. Prior to the study, all individuals were briefed on its purpose and potential risks. Each participant provided written informed consent before taking part. The research protocol received approval from the Ethics Committee of Selçuk University Faculty of Sports Sciences (Protocol number 63, 31.05.2024). The descriptive characteristics of the participants are presented in Table 1.

**Table 1.** Descriptive Characteristics of Participants

| Variable                 | Mean   | Std. Deviation |
|--------------------------|--------|----------------|
| Age (years)              | 22.80  | 1.33           |
| Height (cm)              | 178.67 | 7.30           |
| Body Weight (kg)         | 73.00  | 6.88           |
| BMI (kg/m <sup>2</sup> ) | 22.88  | 0.01           |

### Research Design

Participants were asked to experience the test three times one week before the experiment to familiarize themselves with the experimental devices. The measurements were recorded in a computer environment. Participants were divided into two groups on the first test day (8 and 7 individuals, respectively). The first group was tested after a 1-hour standard tennis training session on a clay court. The other group was measured after training on a hard court. Measurements were taken 15 minutes after training. The same experimental protocol was applied three days later, with the group conditions reversed.

In the study, participants' dynamic and static balance performances were examined in the dominant leg. Participants had no history of musculoskeletal injury in the last six months and reported no balance or vestibular disorders. Individuals with previous lower extremity surgeries or known neurological conditions were excluded. Participants were instructed to refrain from any heavy exercise for 48 hours before the experiment.

The exercise programme consisted of five structured drills designed to challenge various aspects of postural control (Table 2). Each drill targeted specific balance mechanisms such as lateral stability, anticipatory postural adjustments, multidirectional proprioception, and transitions between static and

**Table 2.** Exercise Programme

| Drill Number | Drill Name                  | Description   | Duration | Justification  |
|--------------|-----------------------------|---|----------|--|
| 1            | Forehand and Backhand Shots | Players move laterally, hitting balls alternately from both sides. The coach tosses balls passively.                              | 10 min   | Promotes lateral dynamic stability by requiring control during directional changes         |
| 2            | Hit and Move                | Players hit to parallel and crosscourt targets. The coach actively tosses the ball; players return to the center after each shot. | 15 min   | Enhances anticipatory postural adjustments and dynamic balance under continuous movement   |
| 3            | 25 Shots Drill              | Players change position after every 25 shots and return to the center after each shot.  | 15 min   | Reinforces repeated repositioning and postural realignment for dynamic balance             |
| 4            | Alternate Drill             | Players alternate hitting from the baseline, returning to the center, and running in a figure-eight pattern.                      | 15 min   | Improves multidirectional balance and proprioception through complex movement trajectories |
| 5            | Transition Shots            | Players alternate hitting forehand and backhand shots from the baseline; positions switch every minute.                           | 5 min    | Trains both static and dynamic control by alternating stationery and movement phases       |

dynamic control. The duration and justification of each drill were selected to simulate realistic tennis movement patterns and progressively engage neuromuscular responses related to balance.

#### Balance Measurement

Dynamic balance (with open eyes) and static balance (with closed eyes) were assessed using the Biodex Balance System (BBS, Biodex Medical Systems Inc., Shirley, NY). To ensure familiarity with the testing procedures, each participant performed two preliminary trials. The actual balance test was then conducted on the dominant leg. During the test, participants stood on the BBS mobile platform on one foot, keeping their arms crossed over their shoulders. The difficulty level was set to Level 5 for the dynamic balance test (open eyes) and to a static level for the static balance test (closed eyes). The non-supporting leg remained elevated without contacting the ground. Participants were instructed not to look at the BBS monitor. Upon completion of the test, three balance indices were recorded: Overall Stability Index (OSI), Anterior–Posterior Stability Index (APSI), and Medial–Lateral Stability Index (MLSI). Lower values in these indices indicated superior balance performance [15]. The reliability of this balance assessment protocol was supported by previous validation studies, such as Cachepe et al. [16], which demonstrated high test–retest reliability of the Biodex Balance System in physically active populations.

#### Statistical Analysis

The Shapiro–Wilk test was conducted to assess the normality of the data distribution. As the study followed a within-subject crossover design in which all participants performed on both court surfaces, paired-sample *t*-tests were used to compare balance

index scores (overall, anterior–posterior, and medial–lateral stability) between clay and hard courts.

Cohen’s *d* effect sizes were also calculated to evaluate the magnitude of observed differences. Thresholds were categorized as small ( $d \leq 0.2$ ), moderate (0.5–0.79), and large ( $\geq 0.8$ ) [17]. All statistical analyses were performed using SPSS version 27.0 (SPSS Inc., Chicago, IL, USA), with statistical significance set at  $p < .05$ .

## Results

The comparison of dynamic and static balance performances between clay and hard courts is presented in Table 3. According to the statistical analysis, no significant differences were found in any of the measured balance indices ( $p > .05$ ).

Although none of the differences reached statistical significance, a trend was observed in the Dynamic-MLSI, where balance performance on clay courts ( $M = 1.46$ ) appeared lower (i.e., worse) than on hard courts ( $M = 1.24$ ), approaching the threshold of significance ( $p = .110$ ). Conversely, Static-APSI values were higher on clay courts, suggesting reduced anterior–posterior stability in static conditions, although this difference also did not reach significance ( $p = .301$ ). These findings indicate consistent but statistically non-significant variations in specific balance components between surfaces, warranting further research with larger sample sizes.

The comparison of static and dynamic balance performances on hard courts is presented in Table 4. According to the results, no statistically significant differences were found between static and dynamic conditions across any of the measured indices ( $p > .05$ ).

Although the differences were not statistically

**Table 3.** Comparison of Hard and Clay Court Balance Performances

| Parameters   |      | Mean | Std. Dev. | t      | 95% Confidence Interval of the Difference |       | P    |
|--------------|------|------|-----------|--------|---|-------|------|
|              |      |      |           |        | Lower                                     | Upper |      |
| Dynamic-OSI  | Hard | 2.39 | .68       | .130   | -.3098                                    | .3498 | .898 |
|              | Clay | 2.37 | .72       |        |   |       |      |
| Dynamic-APSI | Hard | 1.76 | .69       | .847   | -.2554                                    | .5888 | .411 |
|              | Clay | 1.59 | .53       |        |   |       |      |
| Dynamic-MLSI | Hard | 1.24 | .35       | -1.078 | -.4963                                    | .0563 | .110 |
|              | Clay | 1.46 | .53       |        |   |       |      |
| Static-OSI   | Hard | 2.72 | .63       | -.097  | -.4616                                    | .4216 | .924 |
|              | Clay | 2.74 | .90       |        |   |       |      |
| Static-APSI  | Hard | 1.92 | .60       | -1.073 | -.6797                                    | .2264 | .301 |
|              | Clay | 2.15 | .88       |        |   |       |      |
| Static-MLSI  | Hard | 1.46 | .68       | .412   | -.1681                                    | .2481 | .686 |
|              | Clay | 1.42 | .72       |        |   |       |      |

Note. OSI = Overall Stability Index; APSI = Anterior–Posterior Stability Index; MLSI = Medial–Lateral Stability Index.  $p < .05$  indicates statistical significance.

significant, certain tendencies were observed. Dynamic balance appeared slightly more favorable in the OSI and APSI measures. For example, the Dynamic-OSI score ( $M = 2.393$ ) was lower than the Static-OSI score ( $M = 2.720$ ), approaching significance ( $p = .078$ ). Similarly, in the MLSI component, the dynamic condition also showed a lower mean ( $M = 1.240$ ) compared to static ( $M = 1.460$ ), with a  $p$ -value of .114. These patterns suggest a possible advantage of dynamic balance over static balance on hard surfaces, though the evidence remains inconclusive.

The comparison of static and dynamic balance performances on clay courts is presented in Table 5. A statistically significant difference was observed in the Anterior-Posterior Stability Index (APSI) between static and dynamic conditions ( $p = .035$ ,  $ES = 0.604$ ). No significant differences were found in the other measured parameters ( $p > .05$ ).

The significant difference in the APSI suggests that dynamic conditions may provide better anterior-posterior stability on clay surfaces compared to static conditions. Specifically, Dynamic-APSI showed a lower mean value ( $M = 1.593$ ) than Static-APSI ( $M = 2.153$ ), indicating improved balance in the anterior-posterior direction when movement is involved. The effect size ( $ES = 0.604$ ) corresponds to a moderate magnitude of difference. Although OSI and MLSI did

not differ significantly, the Dynamic-OSI value ( $M = 2.373$ ) was consistently lower than the Static-OSI ( $M = 2.740$ ), reflecting a potential but non-significant trend toward better overall balance under dynamic conditions. These findings emphasize the possible advantage of dynamic movement in enhancing postural control on clay surfaces, particularly in the anterior-posterior direction.

Figure 1 presents the comparison of static and dynamic balance performances on the clay court across the three balance indices (OSI, APSI, MLSI).

The figure illustrates that mean values for static balance were generally higher than for dynamic balance across all indices, indicating reduced postural stability in static conditions. The most notable difference is observed in the Anterior-Posterior Stability Index (APSI), where static balance values are significantly higher ( $p < .05$ ), as marked by the asterisk. This result aligns with the statistical findings presented in Table 5.

While Overall Stability Index (OSI) and Medial-Lateral Stability Index (MLSI) did not reach statistical significance, both showed slightly higher means in static conditions, suggesting a trend toward better dynamic performance. These visual trends reinforce the idea that dynamic tasks may enhance postural control, particularly in the anterior-posterior direction on clay surfaces.

**Table 4.** Comparison of Static and Dynamic Balance Performances In Hard Court

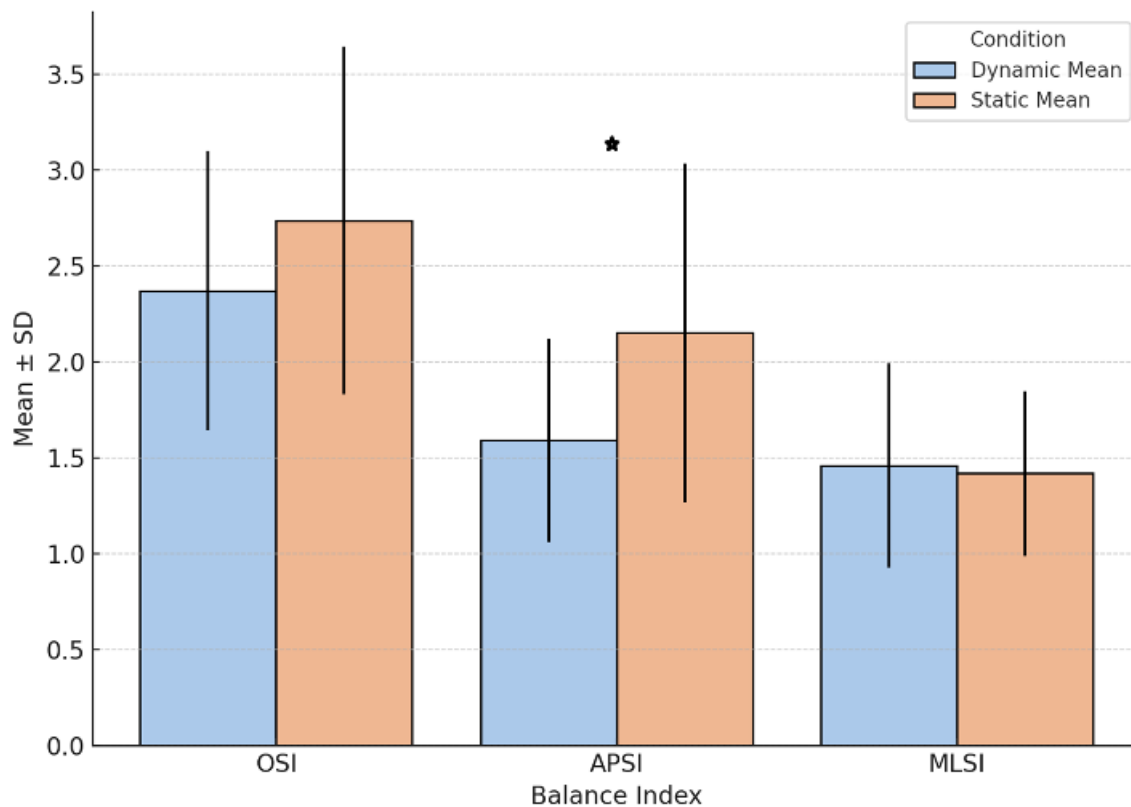
| Parameters   | Mean  | Std. Dev. | t      | 95% Confidence Interval of the Difference |       | p    |
|--------------|-------|-----------|--------|---|-------|------|
|              |       |           |        | Lower                                     | Upper |      |
| Dynamic-OSI  | 2.393 | .6892     | -1.900 | -.6955                                    | .0421 | .078 |
| Static-OSI   | 2.720 | .6361     |        |   |       |      |
| Dynamic-APSI | 1.760 | .6998     | -1.099 | -.4921                                    | .1587 | .290 |
| Static-APSI  | 1.927 | .6076     |        |   |       |      |
| Dynamic-MLSI | 1.240 | .3521     | -1.684 | -.5002                                    | .0602 | .114 |
| Static-MLSI  | 1.460 | .5262     |        |   |       |      |

Note. OSI = Overall Stability Index; APSI = Anterior-Posterior Stability Index; MLSI = Medial-Lateral Stability Index.  $p < .05$  indicates statistical significance.

**Table 5.** Comparison of Static and Dynamic Balance Performances in Clay Court

| Parameters   | Mean  | Std. Dev. | t      | 95% Confidence Interval of the Difference |        | p     |
|--------------|-------|-----------|--------|---|--------|-------|
|              |       |           |        | Lower                                     | Upper  |       |
| Dynamic-OSI  | 2.373 | .7265     | -1.361 | -.9447                                    | .2114  | .195  |
| Static-OSI   | 2.740 | .9054     |        |   |        |       |
| Dynamic-APSI | 1.593 | .5311     | -2.339 | -1.0735                                   | -.0465 | .035* |
| Static-APSI  | 2.153 | .8839     |        |   |        |       |
| Dynamic-MLSI | 1.460 | .5329     | .247   | -.3070                                    | .3870  | .808  |
| Static-MLSI  | 1.420 | .4296     |        |   |        |       |

Note. OSI = Overall Stability Index; APSI = Anterior-Posterior Stability Index; MLSI = Medial-Lateral Stability Index.  $p < .05$  indicates statistical significance.



**Figure 1.** Static vs. Dynamic Balance on Clay Court

### Discussion

This study investigated whether different tennis court surfaces (clay and hard) influence dynamic and static balance performance in novice male players. Although no overall significant differences were found, a notable improvement was observed in the anterior–posterior stability index (APSI) under dynamic conditions on the clay court. This suggests that clay surfaces may enhance dynamic balance in specific directions due to their unique biomechanical demands. These findings provide preliminary evidence that surface type can subtly affect balance performance in novice athletes and may guide surface-specific training strategies.

The superior performance in dynamic balance, specifically in APSI on the clay court, can be attributed to the biomechanical properties of clay, such as increased surface friction and reduced ball speed. These characteristics are known to prolong rallies and demand greater postural adjustments during movement [13]. Frequent deceleration, directional shifts, and adaptation to irregular bounces associated with clay play may stimulate neuromuscular systems more intensively than hard courts, thereby facilitating greater dynamic stability [14]. As reported by Starbuck et al. [13], players perceive clay surfaces as requiring enhanced control, which corresponds with the improved APSI observed in this study. This is further supported by findings that increased traction and compliance on softer surfaces encourage proprioceptive engagement and

dynamic postural responses [14].

While dynamic balance appeared to benefit from the unique demands of clay courts, static balance performance, particularly under eyes-closed conditions, did not significantly differ between surfaces. This aligns with prior literature suggesting that static balance may be less sensitive to environmental or surface-related changes [18]. Static balance involves minimal movement and relies more on intrinsic postural control mechanisms, which may not be substantially influenced by surface properties during short-duration tasks.

The current study focused on novice tennis players, a group often underrepresented in surface-related performance research. Unlike elite players, who develop surface-specific movement adaptations through extensive training and competition [19], novices may not yet exhibit such differentiated responses. This could explain the limited overall variation in balance performance between surfaces. Roetert et al. [20] also emphasized that performance differences based on surface characteristics become more pronounced as skill level increases.

Our testing protocol utilized the Biodex Balance System, which provides reliable measures of both static and dynamic balance [16]. Balance was assessed immediately following a one-hour standardized tennis training session on each surface, which likely induced acute neuromuscular fatigue. Previous research suggests that surface-specific fatigue patterns may influence performance

outcomes [21]. For instance, clay courts generally lead to higher energy expenditure due to longer rallies and slower ball speed, potentially affecting postural control mechanisms differently than hard courts [22].

Interestingly, although longer and more physically demanding rallies on clay could induce greater fatigue, dynamic balance still showed improvement on this surface. This may reflect adaptive motor strategies and increased proprioceptive feedback under complex movement demands [23]. In contrast, hard courts, associated with faster movements and shorter rally duration, may contribute to quicker onset of neuromuscular fatigue [21], but the reduced postural challenge might explain the lack of significant enhancement in balance performance on that surface.

Finally, while our study focused on acute effects, it should be noted that many previous investigations explored the impact of long-term training on balance or other physiological parameters [24]. Our focus on short-term, surface-specific responses, especially in novice players, adds a unique contribution to the literature. The results suggest that even a single session on different surfaces can acutely influence specific aspects of balance performance.

#### Limitations

This study had several limitations that should be addressed in future research. First, the sample size of fifteen novice male players is relatively small, which may limit the generalizability of the findings. Future studies should consider larger, more diverse samples, including players of different skill levels, age groups, and genders. It would also be valuable to assess the impact of different court surfaces over longer durations of play, such as during full matches

or multi-session training blocks, to better capture the effects of fatigue and performance on balance.

Additionally, future studies could explore more specific markers of fatigue, such as heart rate, blood lactate levels, or perceived exertion, to better understand the physiological mechanisms underlying the observed balance differences. It would also be useful to measure the long-term effects of repeated exposure to different surfaces on balance and performance, as players may adapt to specific surfaces over time.

Finally, psychological factors such as mental fatigue, focus, and surface preference could also play a role in balance and performance. These factors may have influenced how players approached the balance tasks and could be explored in future studies to provide a more comprehensive understanding of the interaction between surface characteristics, fatigue, and performance.

## Conclusions

This study examined the short-term effects of clay and hard court surfaces on balance performance in novice male tennis players. While static balance did not differ significantly between surfaces, dynamic balance, specifically anterior-posterior stability, was enhanced on clay courts. These findings indicate that clay court conditions may promote greater neuromuscular and proprioceptive engagement during movement, supporting improved dynamic balance. Incorporating clay court drills into early training programs may therefore be beneficial for developing postural control and on-court stability in novice players.

## Conflict of Interest

The authors declare no conflict of interest.

---

## References

1. Shi Z, Xuan S, Deng Y, Chen L, Xu B, Lin B. *The Effect of Rope Jumping Training on The Dynamic Balance Ability and Hitting Stability among Adolescent Tennis Players: A Systematic Analysis of Randomized Controlled Trials*. 2023. <https://doi.org/10.21203/rs.3.rs-2426206/v1>
2. Haake SJ, Carré MJ, Goodwill SR. The dynamic impact characteristics of tennis balls with tennis rackets. *Journal of Sports Sciences*, 2003;21(10): 839–850. <https://doi.org/10.1080/0264041031000140329>
3. Murias JM, Lanatta D, Arcuri CR, Laiño FA. Metabolic and functional responses playing tennis on different surfaces. *Journal of Strength and Conditioning Research*, 2007;21(1): 112–117. <https://doi.org/10.1519/00124278-200702000-00021>
4. Elliott B. Biomechanics and tennis. *British Journal of Sports Medicine*, 2006;40(5): 392–396. <https://doi.org/10.1136/bjism.2005.023150>
5. Mushtaq U, Suresh T. Comparing the effects of aquatic and land-based balance training programs in male tennis players. *International Journal of Yoga, Physiotherapy and Physical Education*, 2019;4(5): 24–33.
6. Khasawneh A. Anthropometric measurements and their relation to static and dynamic balance among junior tennis players. *Sport Science*, 2015; 8(1): 87–91.
7. Liu Y. Research progress on testing methods and training of human balance ability. *J. Shenyang Inst. Phys. Educ*, 2007; 4: 75-77.
8. Hrysomallis C. Balance Ability and Athletic Performance. *Sports Medicine*, 2011;41(3): 221–232. <https://doi.org/10.2165/11538560-000000000-00000>
9. Chen H, Ning N. The latest progress in the evaluation of human balance function. *Mod. Nurs*, 2006;12, 2173–2175.
10. You Y, Wen A. Evaluation method of human body balance ability. *Chin. J. Rehabil. Med*, 2014;11:1099–1104.

11. Guo Y, Wang H, Tan L. A study on the influence of dynamic balance ability on Tennis Carrier's moving gait. In: *ESE*; 2011.
12. Pearson A. *SAQ tennis: training and conditioning for tennis*. A. & C. Black; 2006.
13. Starbuck C, Damm L, Clarke J, Carré M, Capel-Davis J, Miller S, et al. The influence of tennis court surfaces on player perceptions and biomechanical response. *Journal of Sports Sciences*, 2016;34(17): 1627–1636. <https://doi.org/10.1080/02640414.2015.1127988>
14. Marigold DS, Patla AE. Strategies for Dynamic Stability During Locomotion on a Slippery Surface: Effects of Prior Experience and Knowledge. *Journal of Neurophysiology*, 2002;88(1): 339–353. <https://doi.org/10.1152/jn.00691.2001>
15. Taskuyu E, Atceken DH, Savga MB, Saçikara A, Atalay R, Gungor H. Comparison of static and dynamic balance performances of sports science students by gender. *Physical Education of Students*, 2024;28(5): 261–267. <https://doi.org/10.15561/20755279.2024.0502>
16. Cachupe WJC, Shifflett B, Kahanov L, Wughalter EH. Reliability of Biodex Balance System Measures. *Measurement in Physical Education and Exercise Science*, 2001;5(2): 97–108. [https://doi.org/10.1207/s15327841mpee0502\\_3](https://doi.org/10.1207/s15327841mpee0502_3)
17. Cohen J. *Statistical Power Analysis for the Behavioral Sciences*. 0 ed. Routledge; 2013. <https://doi.org/10.4324/9780203771587>
18. Ponzano M, Gollin M. Effects of hard versus clay courts on athletic performance under conditions of fatigue in competitive tennis. *Medicina dello Sport*, 2018;71(1). <https://doi.org/10.23736/s0025-7826.17.02997-0>
19. Kovacs MS. Tennis Physiology: Training the Competitive Athlete. *Sports Medicine*, 2007;37(3): 189–198. <https://doi.org/10.2165/00007256-200737030-00001>
20. Roetert EP, Brown SW, Piorkowskil PA, Woods RB. Fitness Comparisons Among Three Different Levels of Elite Tennis Players. *Journal of Strength and Conditioning Research*, 1996;10(3): 139–143. <https://doi.org/10.1519/00124278-199608000-00001>
21. Fabre JB, Martin V, Gondin J, Cottin F, Grelot L. Effect of Playing Surface Properties on Neuromuscular Fatigue in Tennis. *Medicine & Science in Sports & Exercise*, 2012;44(11): 2182–2189. <https://doi.org/10.1249/mss.0b013e3182618cf9>
22. Martin C, Thevenet D, Zouhal H, Mornet Y, Delès R, Crestel T, et al. Effects of Playing Surface (Hard and Clay Courts) on Heart Rate and Blood Lactate During Tennis Matches Played by High-Level Players. *Journal of Strength and Conditioning Research*, 2011;25(1): 163–170. <https://doi.org/10.1519/jsc.0b013e3181fb459b>
23. Malliou VJ, Beneka AG, Gioftsidou AF, Malliou PK, Kallistratos E, Pafis GK, et al. Young Tennis Players and Balance Performance. *Journal of Strength and Conditioning Research*, 2010;24(2): 389–393. <https://doi.org/10.1519/jsc.0b013e3181c068f0>
24. Fernandez-Fernandez J, Sanz-Rivas D, Mendez-Villanueva A. A Review of the Activity Profile and Physiological Demands of Tennis Match Play. *Strength & Conditioning Journal*, 2009;31(4): 15–26. <https://doi.org/10.1519/ssc.0b013e3181ada1cb>

---

#### Information about the authors:

**Elif Taşkuyu**; PhD; <https://orcid.org/0000-0002-9724-9149>; elif.taskuyu@hotmail.com; Faculty of Sports Science, Akdeniz University; Antalya, Turkey.

**Sedat Özcan**; (Corresponding Author); PhD; <https://orcid.org/0000-0002-0428-3883>; sedatozcan@sdu.edu.tr; Faculty of Sports Sciences, University of Süleyman Demirel; Isparta, Turkey.

---

Cite this article as:

Taşkuyu E, Özcan S. Effect of different tennis court surfaces on the balance performance of tennis players. *Physical Education of Students*, 2025;29(4):277–283. <https://doi.org/10.15561/20755279.2025.0404>

---

This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited <http://creativecommons.org/licenses/by/4.0/deed.en>

Received: 10.06.2024

Accepted: 14.07.2025; Published: 30.08.2025