OPEN ACESS
Journal of National Kinesiology

ORIGINAL RESEARCH

The acute effects of foam rolling and dynamic stretching protocols on stroke speed performance in adolescent female tennis players

[1]Neslihan Sak [2]Ali Tatlıcı

[1]Selcuk University, Faculty of Sport Sciences, Konya, Türkiye
[2]Selcuk University, Faculty of Sport Sciences, Konya, Türkiye.

Received:
July 09, 2025

Accepted:
September 20, 2025

Online Published:
September 25, 2025

Keywords:
Tennis, Adolescent athletes, Foam rolling, Dynamic stretching.

Abstract. The aim of this study was to investigate and compare the acute effects of foam rolling and dynamic stretching protocols on the stroke speed performance (forehand, backhand, and serve) of adolescent female tennis players. Ten adolescent female tennis players aged 10–13 years, with 3–4 years of playing experience, voluntarily participated in the study at a tennis club in Ankara. Participants had a mean age of 11.50 ± 1.08 years, mean height of 150.50 ± 6.12 cm, mean weight of 41.10 ± 6.66 kg, and an average tennis training background of 3.20 ± 0.42 years. After completing a general tennis-specific warm-up, participants were randomly divided into two groups. The first group performed 8 minutes of dynamic stretching, while the second group performed 8 minutes of foam rolling. Stroke speeds (forehand, backhand, and serve) were measured using a radar gun following each protocol. After a 48-hour recovery period, a crossover design was implemented and the protocols were repeated with the groups switched. Data were analyzed using SPSS software, and paired sample t-tests were used for comparisons. Following the dynamic stretching protocol, mean forehand speed was 80.00±8.60 km/h, backhand speed was 75.60±11.84 km/h, and serve speed was 80.10±16.87 km/h. After foam rolling, forehand speed was 78.30±14.05 km/h, backhand speed was 75.00±12.18 km/h, and serve speed was 80.60 ±15.43 km/h. No statistically significant differences were found between the two protocols in any of the stroke speed measurements ($p>0.05$). The results indicate that neither foam rolling nor dynamic stretching provides a significant acute advantage in improving stroke speed performance in adolescent female tennis players. However, both methods can be considered effective components of a warm-up routine.

Introduction

Tennis is a dynamic sport that combines speed, agility, endurance, technical, and psychological skills (Kovacs, 2006; Stambulova et al., 2009). The forehand, backhand, and serve are fundamental strokes in tennis, each involving technical and biomechanical components that significantly affect a player's overall performance. Moreover, modern tennis requires players to anticipate opponents' actions, adjust strategies quickly, and maintain consistent strokes, making these skills essential for success (Taşkuyu & Özcan, 2025). Analyzing each stroke biomechanically is crucial for technical development (Kokkonen et al., 2007; Bishop & Broughton, 2005).

Biomechanical analysis serves as an essential tool in understanding tennis stroke velocity. Among the key factors influencing stroke speed are the athlete's arm motion and body positioning. Proper arm acceleration and an optimal body position during the stroke especially in high-speed actions like the serve can significantly enhance performance (Irawan et al., 2023). Stroke skill, which is a core component of performance, is directly linked not only to the player's technical proficiency but also to an optimal preparatory routine. Therefore, various training methods and techniques aiming to improve stroke velocity are emphasized in tennis performance development (Kovacs, 2007).

To increase stroke speed, tennis players must be able to efficiently utilize all parts of their bodies. In particular, the interaction between the upper body (arms and shoulders) and the lower body (legs and core muscles) is one of the most important biomechanical factors directly affecting stroke speed (Elliott, Reid, & Crespo, 2009). Furthermore, strength and flexibility training are essential in maximizing this biomechanical synergy (McGill, 2010). Consequently, pre-match or pre-training

✉ N. Sak, e-mail; nesli.sak06@gmail.com
Cıte: Sak, N. ve Tatlıcı, A. 2025. The acute effects of foam rolling and dynamic stretching protocols on stroke speed performance in adolescent female tennis players. *Journal of National Kinesiology. 6(2), 140-145.*

warm-up protocols are vital for activating the musculoskeletal system, improving stroke performance, and reducing the risk of injury (Behm & Chaouachi, 2011; Ayala et al., 2016).

Numerous studies in the literature have examined the effects of different warm-up methods on performance parameters in athletes. These studies have compared the effects of dynamic stretching, foam rolling, and combinations of both techniques (Cheatham et al., 2015; McHugh & Cosgrave, 2010).

Dynamic stretching exercises are active movements that involve lengthening the muscles while in motion. These exercises enhance blood circulation, prepare the musculoskeletal system, and support neuromuscular activation (Yamaguchi & Ishii, 2005). Dynamic stretching enables the body to achieve the flexibility and range of motion necessary for optimal stroke speed (MacIntyre & Moran, 2014). One study showed that dynamic stretching improves athletes' endurance and power output during training (Behm & Chaouachi, 2011). It can be considered a widely used and traditional type of stretching.

Recently, foam rolling exercises, often used in dynamic sports, have gained popularity. Foam rolling helps relax the muscles, increases blood flow, and reduces muscle stiffness. These benefits make it a potentially effective method for improving stroke speed in tennis players (Cheatham, Kolber, Cain & Lee, 2015). Foam rolling facilitates the efficient use of body synergy by helping relax the leg and back muscles (MacDonald et al., 2014). In addition to its performance-enhancing effects, foam rolling has also been shown to accelerate recovery and reduce muscle fatigue after matches (Schroeder & Best, 2015).

However, despite the growing use of dynamic stretching and foam rolling, there is limited evidence regarding their immediate effects on tennis-specific performance, particularly stroke speed. Moreover, most previous studies have focused on adult athletes, leaving a gap in the literature concerning adolescent female players. Addressing this gap is important because physical development, neuromuscular control, and recovery capacity may differ in this population. Based on this background, the present study aimed to investigate the acute effects of two different warm-up protocols dynamic stretching and foam rolling on stroke speed performance in adolescent female tennis players.

Material and Method

Participants

The study was conducted with the voluntary participation of 10 adolescent female tennis players (aged 10–13 years) who had 3 to 4 years of tennis experience and were actively training at Tennis Clinic, a tennis club located in Ankara, Turkey. Participants were selected based on the following inclusion criteria: regular engagement in physical activity and tennis training, no known health problems, and no physical limitations. All performance assessments were conducted prior to training sessions to eliminate potential fatigue effects that might influence the results. The demographic characteristics of the participants were as follows: mean age 11.50 ± 1.08 years, mean height 150.50 ± 6.12 cm, mean body weight 41.10 ± 6.66 kg, and mean tennis experience 3.20 ± 0.42 years. All participants were informed about the study’s objectives and potential risks. The study was approved by the local ethics committee (Protocol number 167, 12/02/2025, Ethics Committee of Selcuk University, Faculty of Sports Science, Konya, Turkey). Before the assessment, every participant received the same detailed information about the testing procedure. Informed consent forms were signed by all participants and their legal guardians in accordance with ethical research standards.

Study Design

This study examined the acute effects of two different warm-up protocols, dynamic stretching and foam rolling, on stroke speed performance in adolescent female tennis players. A randomized crossover design was employed. In the first session, participants were randomly assigned to two groups. The dynamic stretching group performed exercises targeting the quadriceps, hamstrings, gluteus maximus, and gastrocnemius muscles. Each muscle group was stretched for 60 seconds, with the total duration lasting 8 minutes. Movements were performed in a slow and controlled manner to avoid ballistic actions. The timing of each exercise was based on the procedures reported by Behara et al., (2017). The foam rolling group applied foam rolling to the same muscle groups (quadriceps, hamstrings, gluteus maximus, gastrocnemius). Rolling was performed unilaterally, with each muscle group treated for 60 seconds, totaling 8 minutes of application. As with the stretching protocol, the duration of rolling was aligned with the standardized procedures described by Behara et al., (2017). Immediately after the interventions, stroke speed tests were conducted. Forehand, backhand, and serve speeds were measured using a Busnell radar gun (Sports Radar, Bushnell, USA). The radar device was placed 4 meters behind the athlete by an assistant and angled toward the direction of the ball's exit from the racket. Each stroke was performed 5 times, and the best attempt was recorded for analysis (Kara et al., 2015). To minimize residual effects, a 48-hour washout period was implemented. After this period, the groups switched protocols: participants who had performed dynamic stretching in the first session completed the foam rolling protocol, while those who had performed foam rolling completed the dynamic stretching protocol. The same testing procedures were repeated in the second session. This crossover design allowed each athlete to serve as her own control, thereby improving the reliability of comparisons and reducing inter-individual variability.

Statistical Analysis

All statistical analyses were performed using IBM SPSS Statistics version 25.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics (mean ± standard deviation) were calculated for all performance variables, including stroke speeds (forehand, backhand, and serve) under both warm-up conditions (dynamic stretching and foam rolling). To evaluate the normality of the data, both Shapiro-Wilk tests and visual inspection of skewness and kurtosis values were conducted. Skewness and kurtosis values falling within the acceptable range of ±2 were considered indicative of normal distribution. The results confirmed that the data met the assumptions of normality. As each participant completed both intervention protocols in a crossover design, paired samples t-tests were used to compare the stroke speed performances between the two warm-up conditions. The level of statistical significance was set at $p<0.05$.

Findings

Table 1. Descriptive Characteristics of the Participants

Variable	n	Minimum	Maximum	Mean	SD
Age (years)	10	10	13	11.5	1.08
Height (cm)	10	140	157	150.5	6.12
Weight (kg)	10	30	48	41.1	6.66
Tennis Experience (years)	10	3	4	3.2	0.42

Note. SD = Standard Deviation.

Table 2. Comparison of Participants' Dynamic and Foam Roller Stretching Data

	Mean	Std. Dev.		Confidence interval Lower	upper	T	p
Dynamic Forehand	80.00	8.602	1.892	-2.580	5.980	.899	.392
Foam roller Forehand	78.30	14.048					
Dynamic Backhand	75.60	11.843	2.023	-3.977	5.177	.297	.774
Foam roller Backhand	75.00	12.184					
Dynamic Service	80.10	16.868	.910	-2.558	1.558	-.550	.596
Foam roller Service	80.60	15.429					

The average dynamic forehand speed was measured as 80.00 ± 8.602 km/h, while the foam roller forehand speed was 78.30 ± 14.048 km/h. The dynamic backhand speed was found to be 75.60 ± 11.843 km/h, and the foam roller backhand speed was 75.00 ± 12.184 km/h. The dynamic serve speed was recorded as 80.10 ± 16.868 km/h, whereas the foam roller serve speed was 80.60 ± 15.429 km/h. The t-test analyses revealed that there was no statistically significant difference in stroke speed performance between the dynamic and foam roller warm-up protocols ($p > 0.05$).

Discussion and Conclusion

This study aimed to compare the acute effects of two different warm-up protocols on stroke speed performance in adolescent female tennis players, with the goal of identifying which protocol might be more effective. The findings showed no statistically significant difference between the effects of dynamic and foam roller warm-up protocols on stroke speed performance ($p>0.05$).

When reviewing similar studies in the literature, it becomes evident that the effects of dynamic stretching and foam roller protocols on muscle performance vary across different sports disciplines (Behm & Chaouachi, 2011). One study reported that dynamic stretching exercises enhance performance, particularly in movements where speed and power are crucial (Fletcher & Jones, 2004). In a tennis-specific study, lower extremity muscle strength was identified as essential for producing explosive actions such as the tennis serve (Girard & Millet, 2009). It was also noted that a tennis player performing stretching exercises prior to a match might reach full performance only by the end of the second set. Furthermore, a study reported that a 15-second dynamic stretching routine before an isokinetic strength test led to improved performance (Yamaguchi et al., 2007).

Foam roller applications have also shown promise in various sports, where increased muscle elasticity is thought to positively affect speed performance (MacDonald et al., 2013). MacDonald and colleagues observed that foam roller use in volleyball players reduced muscle tension and facilitated faster recovery. Similarly, a study on basketball players highlighted that foam roller exercises accelerated muscle repair and improved performance (Aboodarda et al., 2015).

In the tennis serve, the “rotator cuff” muscles—supraspinatus for abduction, subscapularis for internal rotation, and infraspinatus and teres minor for external rotation—play a significant role, supported by other muscles such as pectoralis major and latissimus dorsi (Özgürbüz & Akşit, 2004; Özgürbüz et al., 2003). These muscle groups share functional similarities with those used in swimming, where shoulder function and muscular balance are crucial for performance. In fact, Bishop and colleagues have emphasized the importance of shoulder strength and conditioning for sprint swimming performance, particularly in relation to reducing muscular imbalances and improving overall efficiency in the water (Bishop et al., 2013).

In another study comparing dynamic stretching and foam roller warm-up protocols, it was observed that foam roller exercises produced similar results to dynamic stretching in terms of jump and strength performance parameters, while having a more favorable impact on joint range of motion (Behara & Jacobson, 2017). Another study on muscle strength reported that foam roller application led to more positive results compared to dynamic stretching in measuring left hamstring strength (Demir, 2018). While many studies indicate that foam rolling enhances muscle elasticity, they also suggest that its effect on performance is not always substantial. The current study supports these findings by demonstrating that both protocols had similar effects on stroke speed.

The measurement results in our study suggest that among tennis players aged 10–13, muscle elasticity and neuromuscular coordination may not be developed enough to create a meaningful difference between the protocols. This could be attributed to the fact that athletes in this age group are still in a developmental phase in terms of muscle structure and flexibility. Another noteworthy finding of the study is that neither protocol had a negative impact on performance. This suggests that coaches can confidently use both dynamic stretching and foam roller routines in various training and pre-match settings.

The findings of this study demonstrated that foam rolling and dynamic stretching protocols did not produce statistically significant acute differences in forehand, backhand, and serve stroke speeds among adolescent female tennis players. However, neither method showed any negative impact on performance. This suggests that both warm-up strategies can be safely incorporated into pre-competition or pre-training routines by coaches and athletes. While dynamic stretching activates the musculoskeletal system and enhances neuromuscular readiness, foam rolling may improve muscle elasticity and reduce tightness. Thus, both approaches appear to prepare athletes effectively for tennis-specific performance, even though no clear superiority was observed in acute stroke speed outcomes. Despite these findings, certain limitations of the present study highlight directions for future research. The relatively small sample size restricts the generalizability of the results, and further studies with larger cohorts are recommended to strengthen the evidence. Investigations across different age groups and including male players would also provide a broader understanding of the effects of these interventions. Moreover, as this research focused solely on acute outcomes, examining the long-term effects of dynamic stretching and foam rolling when incorporated into regular training programs would offer valuable insights. Beyond stroke speed, evaluating additional performance parameters such as agility, reaction time, muscular strength, and flexibility could help clarify the broader impact of warm-up protocols. Finally, it would be beneficial to explore whether combining dynamic stretching and foam rolling into a hybrid protocol produces greater benefits compared to applying each method independently.

Financial Support

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflict of Interest

The authors declare that there is no conflict of interest regarding this article.

Ethics Committee Approval Report

Ethical approval for this study was obtained from the Selçuk University Non-Interventional Clinical Research Ethics Committee Decision (Date: 12.02.2025, Decision No: 167).

Authors' Contribution

Study Design: NS, AT

Data Collection: NS, AT

Statistical Analysis: NS, AT

Manuscript Preparation: NS, AT

Funding Acquisition: NS, AT

References

Aboodarda, S., Spence, A., & Button, D. C. (2015). Pain pressure threshold of a muscle tender spot increases following local and non-local rolling massage. *BMC Musculoskeletal Disorders*, *16*(1), 1–10.

Ayala, F., Moreno-Pérez, V., Vera-Garcia, F. J., Moya, M., Sanz-Rivas, D., & Fernandez-Fernandez, J. (2016). Acute and time-course effects of traditional and dynamic warm-up routines in young elite junior tennis players. *PLOS ONE, 11*(4), e0152790.

Behara, B., & Jacobson, B. H. (2017). Acute effects of deep tissue foam rolling and dynamic stretching on muscular strength, power, and flexibility in Division I linemen. *Journal of Strength & Conditioning Research*, *31*(4), 888–892.

Behm, D. G., & Chaouachi, A. (2011). A review of the acute effects of static and dynamic stretching on performance. *European Journal of Applied Physiology*, *111*, 2633–2651.

Bishop, C., Cree, J., Read, P., Chavda, S., Edwards, M., & Turner, A. (2013). Strength and conditioning for sprint swimming. *Strength & Conditioning Journal, 35*(6), 1-6.

Cheatham, S. W., Kolber, M. J., Cain, M., & Lee, M. (2015). The effects of self-myofascial release using a foam roller or roller massager on joint range of motion, muscle recovery, and performance: A systematic review. *International Journal of Sports Physical Therapy*, *10*(6), 827–838.

Demir, Y. K. (2018). *Statik germe uygulamalarının voleybol oyuncularının dikey sıçrama çeviklik ve sürat performansına olan akut etkileri* (Yüksek lisans tezi, Kırıkkale Üniversitesi). Yükseköğretim Kurulu Ulusal Tez Merkezi.

Elliott, B., Reid, M., & Crespo, M. (2009). *Technique development in tennis stroke production*. International Tennis Federation.

Fletcher, I. M., & Jones, B. (2004). The effect of different warm-up stretch protocols on 20 meter sprint performance in trained rugby union players. *Journal of Strength and Conditioning Research*, *18*(4), 885–888.

Irawan, R., Azam, M., Rahayu, S., Setyawati, H., Priyono, B., & Nugroho, A. (2023). Biomechanical Motion of the Tennis Forehand Stroke: Analyzing the Impact on the Ball Speed Using Biofor Analysis Software. *Physical Education Theory and Methodology, 23*(6), 918-924.

Kara, E., Aksit, T., Ozkol, M., & Isik, T. (2015). Effects of 6-week tennis specific exercises program on service velocity. *Turkish Journal of Sport and Exercise, 17*(1), 71–76.

Kokkonen, J., Nelson, A. G., & Cornwell, A. (2007). Acute effects of passive muscle stretching on sprint performance. *Journal of Human Movement Studies*, *53*(2), 47–56.

Kovacs, M. S. (2006). Applied physiology of tennis performance. *British Journal of Sports Medicine, 40*(5), 381–386.

Kovacs, M. S. (2007). Tennis physiology: training the competitive athlete. *Sports medicine, 37*(3), 189-198.

MacDonald, G. Z., Penney, M. D. H., Mullaley, M. E., Cuconato, A. L., Drake, C. D. J., Behm, D. G., & Button, D. C. (2014). Foam rolling as a recovery tool after an intense bout of physical activity. *Medicine & Science in Sports & Exercise*, *46*(1), 131–142.

MacIntyre, T. E., & Moran, A. P. (2014). *Sport and exercise psychology: A critical introduction*. Routledge.

McGill, S. M. (2010). Core training: Evidence translating to better performance and injury prevention. *Strength and Conditioning Journal*, *32*(3), 33–46.

McHugh, M. P., & Cosgrave, C. H. (2010). To stretch or not to stretch: The role of stretching in injury prevention and performance. *Scandinavian Journal of Medicine & Science in Sports*, *20*(2), 169–181.

Özgürbüz, C., & Akşit, T. (2004). The concept of a triple-component strength ratio of the shoulder rotator muscle in tennis players. *Deutsche Zeitschrift für Sportmedizin*, *55*, 96–100.

Özgürbüz, C., Akşit, T., Acar, M. F., Ertat, A., & Durmaz, B. (2003). Elit tenisçilerde omuzun fonksiyonel kuvvet ölçümleri. *Spor Hekimliği Dergisi*, *38*, 73–78.

Stambulova, N., Alfermann, D., Statler, T., & Côté, J. (2009). ISSP position stand: Career development and transitions of athletes. *International Journal of Sport and Exercise Psychology, 7*(4), 395–412.

Taşkuyu, E., & Özcan, S. (2025). Effect of different tennis court surfaces on the balance performance of tennis players. *Physical Education of Students, 29*(4), 277–283.

Yamaguchi, T., & Ishii, K. (2005). Effects of static stretching for 30 seconds and dynamic stretching on leg extension power. *Journal of Strength and Conditioning Research*, *19*(3), 677–683.