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Examination of the Acute Effects of Foam Roller on Performance in Volleyball Players

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Abstract

The aim of this study is to examine the acute effects of foam roller application on some performance data after static and dynamic stretching exercises in volleyball players. 12 male athletes with an average age of 21.5±2.15, height of 1.83±1.19 and body weight of 71±3.51 participated in the study voluntarily. As an exercise protocol, Foam Roller exercises combined with static/dynamic warm-up and static-dynamic warm-up were carried out on two separate days. On the first day of the study, performance data were measured after a 10-minute warm-up run (8 minutes running, 2 minutes walking) and 5 static/5 dynamic stretching exercises (3 repetitions of each movement, 15 seconds of practice, 5 seconds of rest). On the second day, a 10-minute (8-minute run, 2-minute walk) warm-up run was performed, static/dynamic warm-up followed by a foam roller (3 repetitions of each movement, 15 seconds of practice, 5 seconds of rest). The participants' performances were evaluated with 30-meter speed, agility and flexibility measurements. Data analysis was done with SPSS 23.0 package program. Data were analyzed with a 95% confidence interval. Evaluation of the difference between different warm-up protocols was evaluated with the Wilcoxon Signed-Rank test. According to the measurements made, no statistically significant difference was found in the speed (z=-0,615, p=0,58), agility (z=-1,7, p=0,18) and flexibility (z=-0,398, p=0,63) parameters between the static/dynamic warm-up and static/dynamic warm-up combined Foam Roller protocols. As a result, it can be said that foam roller exercises in addition to static-dynamic warm-up do not affect the physical performance of volleyball athletes.

Keywords: Dynamic warm-up, foam roller, volleyball

Introduction

Volleyball is a dynamic team sport that requires a high level of physical and physiological capacity. Success in this branch requires physical characteristics such as strength, speed, agility, and flexibility as well as the perfect integration of the musculoskeletal system and nervous system (Sheppard et al., 2008). At the same time, strength training is also very important in the development of these physical features (Kirişci & Gök, 2022).Therefore, it is thought that practices aimed at improving flexibility, range of motion and muscle function, agility and speed abilities are of great importance in order to optimize performance in volleyball players. Warming up is a preliminary preparation process applied to increase the physical performance of athletes and reduce the risk of injury (Bishop, 2003; Köse, 2014). In sports such as volleyball, which require explosive strength and fast reactions, an effective warm-up process plays a critical role in optimizing performance. A well-structured warm-up increases the effectiveness of the musculoskeletal system, nervous system and cardiovascular system, allowing athletes to adapt to exercise more efficiently. During warm-up, physiological changes such as increased muscle temperature, increased enzyme activity and increased neuromuscular efficiency occur. These changes positively affect performance indicators such as flexibility, agility and speed (Bishop, 2003). In order for athletes to exhibit optimum performance in volleyball, it is recommended to apply a series of movements that include static and dynamic stretching (Feng, 2024). Static stretching exercises involve stretching a muscle in a certain position for a fixed period of time (Bushman, 2016). Static stretching increases the elasticity of the muscles, increases joint range of motion and improves flexibility performance (Behm & Chaouachi, 2011). Static stretching is usually most effective when combined with dynamic warm-up. Research shows that static stretching exercises applied alone can lead to performance loss on movements that require short-term strength and explosive power, but this effect disappears when combined with dynamic exercises (Behm & Chaouachi, 2011). Therefore, the duration and intensity of static stretching applications in volleyball players should be planned carefully. Dynamic stretching involves the controlled stretching of muscles through a specific range of motion and is accomplished by maintaining a movement through the joint's range of motion. (Bushman, 2016; Gibson et al., 2024). Dynamic stretching stands out as an effective and useful warm-up method for activities requiring explosive movements, rapid changes of direction, and wide range of motion in volleyball. This method prepares the athlete's physiological and neuromuscular system, creating direct positive effects on performance. Dynamic stretching increases the ability of fast contractions by providing optimal flexibility and elasticity to the muscles (Turki et al., 2012). In the literature, current studies are investigating the combination of more than one method to increase efficiency (Hendricks et al., 2020; Pagaduan et al., 2012). Today, athletes' performance is constantly being investigated with various current strategies to optimize their physical and physiological capacities. One of the methods used to increase performance with goals such as flexibility, range of motion and improvement of muscle tissue is the Foam Roller (FR) application, which has gained popularity in recent years (Cheatham et al., 2015). FR is a technique used to reduce tension on muscles, fascia (connective tissue), and soft tissues. FR is a type of self-myofascial release in which an individual uses a tool to apply direct pressure to targeted muscles (Freiwald et al., 2016; Healey et al., 2014). In FR, the user applies pressure to the soft tissues using their body weight, while a rolling motion is performed. For athletes, self-myofascial release is often used to improve recovery and performance (Cheatham et al., 2015; Baumgart et al., 2019). This study examines the effects of FR application during the warm-up process in volleyball. The aim of this study is to reveal

the acute effects of FR application after static and dynamic stretching exercises on some performance parameters in volleyball players. In this context, static-dynamic warm-up and FR applications combined with static-dynamic warm-up were compared. Providing up-to-date information on how to optimize warm-up protocols in volleyball players, this study presents guiding data for planning the warm-up process by revealing the effects of combining static-dynamic stretching exercises with FR application on performance variables (speed, agility, flexibility). In addition, considering the limited number of studies considering volleyball-specific performance needs, this study provides an original contribution to the field of warm-up protocols for team sports. The obtained data strengthen the scientific basis for performance optimization in team sports by providing an up-to-date and original perspective on the use of FR in volleyball players' warm-up protocols.

Materials and Methods

Ethics Committee Permission

The research was implemented after the ethics committee decision of Iğdır University dated 17.12.2024 and numbered E-37077861-900-158335 was obtained.

Sample

Twelve male athletes with an average age of 21.5±2.15, height of 1.83±1.19cm and body weight of 71±3.51kg participated voluntarily in the study. The athletes who participated in the study were informed about the purpose of contribution and the content, and the volunteers were given their consent. The ethics committee approval for the study was obtained from the Iğdır University Scientific Research and Publication Ethics Committee Presidency with the meeting number 2024/34 dated 17.12.2024.

Study Design

As an exercise protocol, static/dynamic warm-up and static-dynamic warm-up combined with foam roller applications were performed on two separate days with 48-hour intervals. In the first session of the study, 10 (8-minute run, 2-minute walk) minutes of warm-up running and 5 static/5 dynamic stretching (each movement 3 repetitions, 15 seconds of application, 5 seconds of rest) warm-up exercises were performed followed by 3-minute rest, and performance data were measured. In the second session, 10 (8-minute run, 2-minute walk) minutes of warm-up running and static/dynamic warm-up followed by foam roller application (each movement 3 repetitions, 15 seconds of application, 5 seconds of rest) were performed. After 3 minutes of rest, participants' performance data were measured. Participants' performances were evaluated with 30-meter speed, agility (T test) and flexibility measurements.

Static and Dynamic Stretching Protocol

After a 10-minute (8-minute run and 2-minute walk) light warm-up run, the stretching exercises performed were modified bar stretching, stretching hip rotators, touching the tips of toes when bent to the front, quadriceps stretching and calf stretching, respectively, each exercise was performed 3 times with 15 seconds of application and 5 seconds of passive rest. After static stretching exercises, as seen in figure 2 dynamic stretching movements of high knee walk, high knees, butt kicks, lunge walks and straight leg kick respectively and open hips were performed for 3x15 seconds x 5seconds rest for each leg (Köse, 2014).

Static, Dynamic and Foam Roller Stretching Protocol

Foam roller exercises were applied to 4 muscle regions of the bilateral lower extremities (quadriceps, hamstring, gluteus, gastrocnemius) from distal to proximal, respectively, after static and dynamic exercises. First, participants applied foam roller to a muscle region of the right lower extremity, then to the same muscle region of the left lower extremity. Foam roller was applied to each unilateral muscle region for 45 seconds (Tsai & Chen, 2021).

Data Collection Methods

30m Sprint

To determine the speed of the volleyball players, 30-meter sprint tests were performed twice with a 5-minute rest break and the best time was recorded. For the speed test, the athletes started from one meter behind the starting photocell and the running time was automatically recorded after they reached the finish photocell at a distance of 30 meters.

Flexibility Measurements

For this test, participants were asked to sit on the ground with their feet bare, rest the soles of their feet on the test stand and push the digital indicator on the stand forward with both hands without bending their legs. They were held at the last point they could reach for 2 seconds and the value on the indicator was taken. The subjects repeated this 3 times and the best value was evaluated (Köse &Atan, 2015).

Agility

The duration of the course was measured with a photocell. The start was made 1 meter behind the photocell. Two trials were made at 5-minute intervals and the best time was recorded.

Statistical Analysis

The analysis of the data obtained in the study was performed using the SPSS 22 program. The Wilcoxon Signed-Rank test was used to record the differences between different stretching protocols. The significance level was accepted as $p<0.05$.

Results

Table 1. Comparison of sprint, agility and flexibility means of the participants after different stretching protocols

Parameters	Static-Dynamic Stretching Mean±SD	Static-Dynamic Stretching Foam Roller Mean±SD	z	p
Sprint (sec)	4.66±0.16	4.69±0.14	-0.615	0.58
Agility (sec)	11.7±0.19	11.3±0.22	-1.70	0.18
Flexibility (cm)	37.3±2.41	37±2.31	-0.398	0.63

*P< 0.05

According to the measurements, no statistically significant difference was found between the static/dynamic warm-up and static/dynamic warm-up and combined Foam Roller protocols in the parameters of speed (z=-0.615, p=0.58), agility (z=-1.7, p=0.18), flexibility (z=-0.398, p=0.63).

Discussion

According to the data of our study, foam roller applications in addition to static and dynamic warm-up do not have an acute effect on sprint, agility and flexibility parameters ($p>0.05$). In a study conducted on elite volleyball players, no significant difference was found in speed, agility and flexibility parameters between static-dynamic warm-up and static-dynamic warm-up combined with Foam Roller protocols. As a result, they stated that FR applications applied in addition to static-dynamic warm-up did not affect physical performance in elite volleyball players (Akçay et al., 2023). In another study, it was stated that FR applications in addition to dynamic stretching did not affect sprint and agility performance (Yıldız et al., 2018). The findings of these studies are parallel to our study.

Healey et al. (2014) stated that the acute FR exercise protocol had no superiority over other exercise protocols in terms of agility and muscular power output development. In different studies conducted with young volleyball players, there are no statistically significant differences between the warm-up methods used in relation to the evaluated movement indicators dynamic stretching, warm-up with foam roller, and the combination of dynamic stretching and foam roller (Popelka et al., 2024; Popelka & Pivovarniček, 2022). In a study involving female volleyball players the lower extremity flexibility values of self-applied foam roller exercises of different durations (30 seconds-60 seconds) were investigated. When the results of the study were examined, it was emphasized that foam roller exercises of different durations had no superiority over the control group and also did not have a negative effect (Sali, 2019). In another study Linderoth (2015) observed that 5 minutes of foam roller and dynamic stretching protocols performed after a 5-minute general warm-up had a similar effect on increasing 20 m sprint performance.

In contrast to these studies, a study conducted with 16 male NCAA elite volleyball players emphasized that foam roller exercises can increase sprint performance (Tsai & Chen, 2021). In a study conducted on male individuals active in various sports branches, it was stated that an acute warm-up session performed with a foam roller in addition to dynamic warm-up improved acute performance parameters such as agility and speed compared to an acute dynamic warm-up performed without a foam roller, but did not affect flexibility performance. Therefore, it has been stated that including foam roller applications with dynamic warm-up can be a useful method to improve physical performance (Peacock et al., 2014). In addition, some studies have concluded that although foam roller applications combined with dynamic stretching do not have a significant increase in agility and sprint data, they still have the potential to have a positive effect (Beyleroğlu et al., 2021; MacDonald, 2013).

When the literature is examined, it is seen that there are contradictory and inconsistent results and that the discussions continue. We think that the most important reasons for these contradictions may be the age, sport level, gender of the participant groups, and the lack of standard protocols used in the studies. In addition, the number of studies conducted on volleyball players in the literature is limited and more research is needed. In future studies, athletes with higher sports backgrounds and elite levels and larger groups can be included in the studies to observe the developments of foam roller exercises on sports performance.

Conclusion

As a result, it can be said that foam roller applications in addition to static/dynamic stretching exercises for non-elite male volleyball players do not acutely affect biomotor characteristics such as agility, speed and flexibility compared to just static and dynamic warm-ups.

Limitations

There are some limitations to our study. These include the non-elite volleyball group, relatively small sample size, and the protocol being different from other studies.

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