

Leg Fatigue in Division III Female Soccer and Volleyball Athletes Throughout The Regular Season

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Abstract

PURPOSE: Ideal timing for athletes to reach their peak performance and fitness level is at the end of the regular season before postseason matches. Power output and fatigue can be tracked by testing vertical neuromuscular patterns throughout the length of a regular season. The aim of this study was to determine peak power, mean power, fatigue index, and vertical height in an attempt to track leg fatigue at various points during the season. Neuro-muscular function and leg power was measured through: (1) a counter movement jump (CMJ) test utilizing a 3D accelerometer Myotest and (2) a jump-reach test for vertical height through the use of a Vertec. Tracking these results may benefit both coaches and athletes in order to properly train during the regular season and to promote peak power plus diminished fatigue at purposeful times.

METHODS: Twenty-four female Division III volleyball (n=16) and soccer (n=8) athletes (age 18.7 yrs. \pm 0.89 SD, weight 150.4 lbs. \pm 21.1, height 67.1 in. \pm 2.9) participated in this study. Subjects were familiarized on how to perform the CMJ and maximum jump-reach test for vertical height prior to data collection. CMJ data was collected using the Myotest for all subjects every three weeks for 12 weeks during the regular season. The jump-reach test was tested during the first and last testing periods.

RESULTS: Using a paired sample t-test, volleyball subjects experienced a significant (pre=18.03 \pm 2.98, post=18.88 \pm 2.77, p=0.021) increase in their jump-reach test for vertical jump height, while soccer showed no significance (pre=18.81 \pm 2.40, post=18.00 \pm 2.10, p=0.216). No significance was found using the Myotest for height, power, force, and speed throughout the season for either soccer (p=0.455, p=0.715, p=0.939, p=0.566) or volleyball (p=0.967, p=0.864, p=0.818, p=0.910), respectively.

CONCLUSION: This study shows a significant increase in volleyball players jump-reach test, but does not show a significant difference in leg power and possible fatigue of Division III female soccer and volleyball players. The volleyball players may have gained motor unit recruitment through the natural regiments of the sport to better perform the jump-reach test and improve jump efficiency, while the soccer players did not under this investigation. The high number of dropouts could have affected significance values.

Introduction

The ideal timing for athletes to reach peak performance is around the end of their regular season just before going into potential playoffs. However, some training schedules cause athletes to fatigue sooner or later than the ideal. The sports of soccer and volleyball require optimal leg power in order to perform at a high playing level. Power output and fatigue can be tracked through vertical jump neuromuscular patterns throughout the length of a regular season. In this study, peak power, fatigue index, and vertical height were determined to track imbalances in the lower extremities. Neuromuscular function was measured through a counter movement jump test utilizing a 3D accelerometer device (Myotest, Switzerland). Vertical jump height through the use of a Vertec was also used to determine full-body jump efficiency (Lees, 2004). Tracking these results will be beneficial to both the coaches and the athletes in order to properly train and promote peak power and diminished fatigue at the appropriate time during a regular season.

Methods

Twenty-four female Bethel University Division III volleyball (n=16) and soccer (n=8) athletes (age 18.71 yrs. \pm .89, weight 150.43 lbs. \pm 21.14, height 67.16 inch. \pm 2.97) participated in this study. The subjects were familiarized on how to perform a countermovement jump (CMJ) prior to data collection. Lower extremity neuromuscular data was collected using the Myotest on the subjects every three weeks during their regular season. The Myotest device was placed on the belt and properly fitted around the waist of the participant. The subject stood with feet shoulder width apart and placed their hands on their hips. As the audio signal sounded, the subject bent their knees and jumped as high as possible with a natural, soft landing. After the landing, the participant returned to the initial position and waited for the next sound signal, at which point the jump technique was repeated. A total of five CMJs were completed each testing session. The participants were also instructed how to perform a jump-reach test for vertical height that was measured by a Vertec measuring device. Reach height for the jump-reach test was established using the following body position: erect stance, both feet together and flat on the ground, dominant arm fully extended overhead, and the head and eyes level. Subjects were then given directions on the proper technique for the jump test. They performed a standing, counter movement jump with the use of their arms. Jumps continued until the participants failed to reach a higher height three times in a row. The jump-reach test was tested on the first and last testing periods.

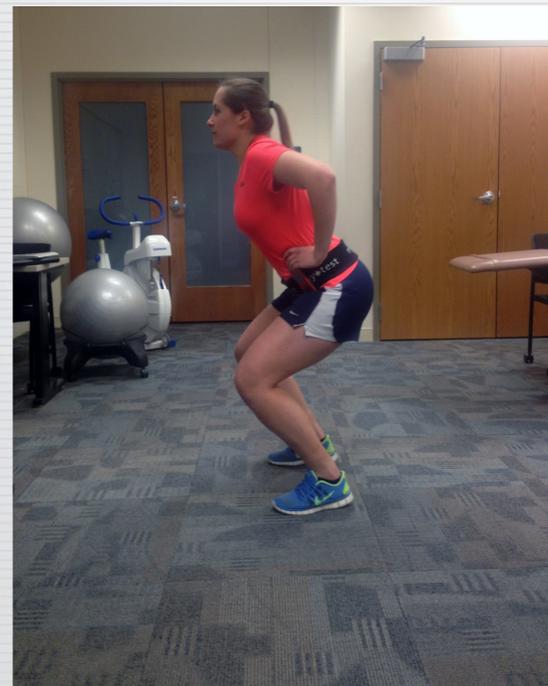
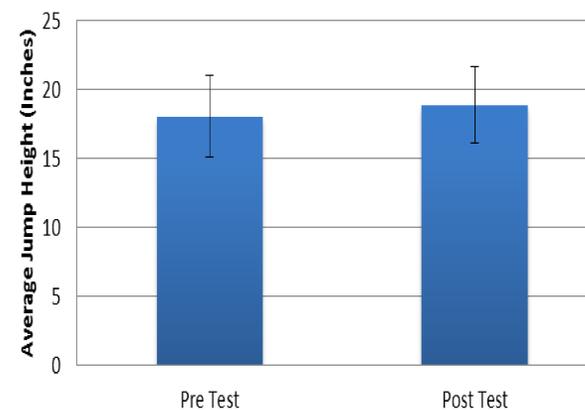


Figure 1: Comparison Pre and Post Volleyball Jump Reach Height



Results

Using a paired sample t-test, volleyball subjects experienced a significant (pre=18.03 \pm 2.98 inches, post=18.88 \pm 2.77 inches, p=0.021) increase in their jump-reach test for vertical jump height, while soccer showed no significance (pre=18.81 \pm 2.40 inches, post=18.00 \pm 2.10 inches, p=0.216). No significance was found using the Myotest for height, power, force, and speed throughout the season for either soccer (p=0.455, p=0.715, p=0.939, p=0.566) or volleyball (p=0.967, p=0.864, p=0.818, p=0.910), respectively. The average vertical heights using the Myotest for volleyball were 12.44 \pm 1.95 inches and 12.43 \pm 1.42 inches for the pre and post tests, respectively. The average vertical heights using the Myotest for soccer were 11.68 \pm 0.72 inches and 10.75 \pm 1.28 inches for pre and post tests, respectively. Statistical analyses were conducted in SPSS.

Conclusion

This study shows a significant increase in volleyball players jump-reach test, but does not show a significant difference in leg power and possible fatigue of Division III female soccer and volleyball players. The volleyball players may have gained motor unit recruitment through the natural regiments of the sport to better perform the jump-reach test and improve jump efficiency, while the soccer players did not under this investigation. There are multiple factors for why the jump-reach test vertical heights were greater than those found using the Myotest. The use of arms in a vertical jump has been shown to contribute to full body efficiency and increase the overall jump-reach height (Harmon, 1990; Lees, 2004). The use of an overhead goal has also been shown to increase vertical height (Ford, 2005). Although it was not found to be significant, there was a negative correlation in the jump-reach test vertical height among the soccer players. This may be attributed to slow twitch muscle fibers predominantly being used in the sport as compared to the fast twitch fibers predominantly being used in volleyball. Since soccer is not a dominant jumping sport, muscle memory for motor recruitment may have also been a factor in the decreased vertical jump height. Studying lower-body neuromuscular recruitment during the regular season for both sports will be beneficial for coaches and players. Tracking power and vertical height, specifically, will allow patterns of over or under training to be determined. This will allow for structural changes in practices to occur in order for the athletes to reach peak performance at the proper time. An area that can also be examined is the potential imbalances of concentric and eccentric forces used by each athlete. Based on the recorded numbers, it may be possible to determine a higher risk for injury during the season. This study began with 43 athletes, while only 24 completed every testing session. Reasons for discontinuing the study included injuries, quitting the sport, or lack of time. Only subjects who completed every session had their data included in this study. The high number of dropouts could have affected significance values.

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