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RESEARCH ARTICLE

Impact of Scapular Muscles and Core Muscles Endurance on Agility in College Level Basketball Players

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ABSTRACT

Objective: Athletic success depends on the endurance of the scapular and core muscles, especially in dynamic games like basketball where stability, agility, and injury avoidance are critical. This study looked at the relationship between scapular and core muscle endurance in collegiate basketball players as well as the relationship between these muscle endurance levels and athletic performance, namely agility. **Methods**: Forty-nine college basketball players (mean age: 24.20 ± 2.1 years, 61.2% male, 38.8% female) participated in this study. Core muscle endurance was assessed through tests measuring flexor and extensor endurance, as well as side-bridge endurance on both sides. Scapular muscle endurance was measured on the right and left sides. Agility was evaluated using standard tests. Measures of muscle endurance and agility performance were compared using Pearson's correlation coefficients. **Findings**: Agility and core extensor endurance were shown to be significantly positively correlated ($R = 0.510$, $p = 0.001$). Likewise, agility was positively correlated with both right- and left-side bridge endurance (right-side $R = 0.482$, $p = 0.001$; left-side $R = 0.457$, $p = 0.001$). However, there was no discernible relationship between agility and core flexor endurance. There were notable inverse relationships between total core muscle endurance and side bridge and core extensor endurance. **Novelty**: This study offers fresh perspectives on how scapular and core muscular endurance relate to one another, emphasising their critical roles in athletic performance, especially in dynamic sports, such as basketball. These findings also suggest that training programs should focus on enhancing both the muscle groups for optimal performance and injury prevention.

Keywords: Scapular endurance; Core endurance; Basketball performance; Agility

1 INTRODUCTION

Basketball players' athletic performance is greatly influenced by their scapular and core muscle endurance [1,2]. For stability, balance, and good posture during dynamic movements, the core muscles—which include the abdominal, lower back, and pelvic muscles—are crucial [3]. Likewise, the scapular muscles, which are responsible for stabilising the shoulder blades and facilitating upper-body movements, are crucial for actions such as shooting, passing, and rebounding.In basketball, these muscles must work synergistically to support rapid changes in direction, explosive jumps, and repetitive motion, all of which are integral to performance [4,5].

Studies have shown that basketball players exhibit distinct scapular characteristics compared with high school players and non-athletes. The impact of arm dominance on scapular muscle strength and endurance revealed that, while the differences were not clinically significant, the dominant arm had significantly greater upper trapezius strength and endurance [6]. The recent finding that rotator cuff weakness and particular infraspinatus dysfunction can result from scapular dyskinesis in overhead athletes highlights the significance of scapular muscle function [7]. Basketball players' entire athletic and skill performance, including strength, sprinting, jumping, balance, and agility, can be enhanced by core training, which is essential for core muscular endurance [1]. This raises the possibility of a connection between basketball players' overall performance and the endurance of their core muscles.

Gaining knowledge about the relationship between scapular and core muscle endurance may help one better understand how these muscle systems work together and affect one another during exercise. This knowledge may lead to more effective training regimens aimed at enhancing the overall muscle endurance, reducing injury risk, and improving athletic performance. This study aimed to explore the correlation between scapular muscle endurance and core muscle endurance in college-level basketball players.

2 MATERIALS AND METHODS

The data for this study included basketball players who had been playing sports for more than six months at Krupanidhi College and other basketball academies in Bangalore. Convenience sampling was used to collect data. The study utilised a correlation design, with a sample size of 49 participants, and the study duration was six months.

The inclusion criteria for the participants were both male and female players, aged between 18 and 30 years, who had been playing basketball for more than six months, and were non-professional, college-level athletes. It was necessary for participants to need to improve in areas like strength, agility, flexibility, range of motion (ROM), speed, or endurance.

The exclusion criteria included players who had experienced a musculoskeletal or abdominal injury requiring treatment within the past 60 days or those currently participating in a core stability training program.

The study's outcome measurements included the Agility T-test, the Scapular Endurance Test, and the McGill Endurance Test (which includes the Side Bridge, Sorensen, and Trunk Flexors Endurance Tests).

3 RESULTS

The mean age of the players was 24.20 ± 2.1. Approximately 61.2% of the participants were male (30), while 38.8% were female (19), showing a male predominance. In terms of core muscle endurance, the mean endurance for the flexors was 80.08 ± 29.74, and for the extensors, it was 86.79 seconds ± 19.47. The side bridge endurance on the right side had a mean of 51.65 ± 18.65, while that on the left side was slightly lower at 51.52 ± 17.39. For scapular muscle endurance, the right side had a mean of 77.48 ± 18.91, while the left side showed a mean of 71.79 ± 17.96 (Table 1).

Agility time was 11.99 ± 0.62 on average. The flexors did not significantly correlate with agility for core muscular endurance, according to Pearson's correlation coefficients (R = -0.018, p = 0.902). But the extensors and the right (R = 0.482, p = 0.001) and left (R = 0.457, p = 0.001) side bridges showed a strong positive connection with agility (R = 0.510, p = 0.001). For core muscle endurance, the flexors showed no significant correlation with other measures of endurance (R = 0.027, p = 0.854), whereas the extensors and side bridges demonstrated significant negative correlations with core muscle endurance. Specifically, the extensors (R = -0.379, p = 0.007), right-side bridge (R = -0.364, p = 0.010), and left-side bridge (R = -0.323, p = 0.023) all had significant negative correlations with core muscle endurance. The results indicated that extensors, side bridges, and agility are significantly related (Table 2).

Table 1: Basic Characteristics and muscle endurance of basketball Players

Characters	Mean ± SD
Age	24.20 ± 2.1
Gender	**n (%)**
Male	30 (61.2%)
Female	19 (38.8%)
Core muscle endurance (seconds)	
Flexors	80.08 ± 29.74
Extensors	86.79 ± 19.47
Side bridge right	51.65 ± 18.65
Side bridge left	51.52 ± 17.39
Scapular muscle endurance (seconds)	
SME right	77.48 ± 18.91
SME left	71.79 ± 17.96

Table 2: Agility, core and scapular muscle endurance, and their correlations in basketball players

Agility (seconds)	Mean ± SD	
Agility 'T' test	11.99 ± 0.62	
Pearson's correlation		
Core muscle testing	**R**	**p**
Flexors	-0.018	0.902
Extensors	0.510	0.001*
Side bridge right	0.482	0.001*
Side bridge left	0.457	0.001*
Core muscle endurance (Seconds)		
Flexors	0.027	0.854
Extensors	-0.379	0.007*
Side bridge right	-0.364	0.010*
Side bridge left	-0.323	0.023*

*Significant

4 DISCUSSION

The endurance measurements found in this study demonstrated a substantial correlation between scapular muscle endurance and core muscle endurance in collegiate basketball players. According to these results, scapular and core muscle endurance are essential for both injury prevention and sports performance.

The study included 49 college basketball players with a mean age of 24.20 ± 2.1 years, predominantly male (61.2%). Core muscle endurance was measured with flexors averaging 80.08 ± 29.74 seconds and extensors at 86.79 ± 19.47 seconds. Scapular muscle endurance showed right-side endurance at 77.48 ± 18.91 seconds and left-side at 71.79 ± 17.96 seconds. Scapular and core muscular endurance have been found to be somewhat positively correlated in prior research, indicating that gains in one may increase those in the other[8,9]. Specifically, one study indicated that scapular endurance positively correlates with core endurance tests, showing the interconnectedness of these muscle groups in athletic performance[8]. Enhanced scapular and core endurance can lead to improved stability, balance, and overall athletic function, which are critical in basketball[8].

The present study's findings indicate that while core flexor endurance does not correlate significantly with agility or other endurance measures, core extensor endurance and side bridges show a strong positive correlation with agility. Agility and core extensor endurance were shown to be significantly positively correlated (R = 0.510, p = 0.001). Additionally, there was a positive correlation between agility and both the left (R = 0.457, p = 0.001) and right (R = 0.482, p = 0.001) side bridges, suggesting their significance in performance. However, there were notable negative associations between overall core muscle endurance and side bridges and core extensor endurance (left-side bridge: R = -0.323, p = 0.023; right-side bridge: R = -0.364, p = 0.010; and extensors: R = -0.379, p = 0.007). This indicates that while these muscles may not improve core endurance, they do contribute to agility. The findings demonstrate the necessity of focused training regimens that emphasize building side-bridge and extensor endurance in order to increase basketball players' agility[8,10].

The scapular and core muscles' endurance is related to performance and injury risk, and they may have an impact on one another. According to our research, scapular and core muscular endurance are positively correlated. Several processes can be used to explain this association. The first is the thoracolumbar fascia, which forms a band over the trunk and joins the upper and lower extremities, as well as the right and left kinetic chain segments[11,12]. The latissimus dorsi gives birth to the superficial lamina of the posterior layer, which joins the transversus abdominis to produce a fascial cover that contains muscles including the pectoralis major, rhomboideus, trapezius, and serratus anterior. This fascia is essential for moving weight and energy between the lumbopelvic area and the upper and lower limbs[13]. Furthermore, the spine is stabilized by the thoracolumbar fascia, internal obliques, and transversus abdominis[14]. Additionally, by contracting before limb movement, the diaphragm helps to stabilize the spine[12].

The "serape effect" is another mechanism that strengthens the bond between the body and the extremities[13]. This method explains how the muscles that make up the body are crisscrossed, producing force between the contralateral hips and shoulders. The "serape effect," which involves muscles including the rhomboideus, serratus anterior, and oblique abdominal muscles, is the diagonal tension that occurs during shoulder and hip rotation[14]. Gracovetsky's spinal machine theory states that these muscles cooperate to produce rotator torque, which makes functional actions like walking and throwing possible[15]. These mechanisms highlight the integration of the body and extremity segments in the kinetic chain.

The lack of a correlation between core flexor endurance and agility suggests that not all core muscle groups contribute equally to athletic performance, highlighting the complexity of muscle interactions in sports. Further research is needed to explore these dynamics in greater detail. These findings support the need for targeted training programs that focus on both muscle groups to optimise performance and reduce injury risk.

5 CONCLUSION

The study's conclusions make it clear that college basketball players' scapular and core muscle endurance are significantly correlated, highlighting the vital roles these muscles play in both injury prevention and athletic success. Core extensor endurance and side bridge performance were strongly correlated with agility, suggesting their importance in dynamic movements, such as those seen in basketball. These findings highlight the need for targeted training programs that focus on enhancing both scapular and core endurance to optimise performance and reduce the risk of injury in athletes.

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