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Original Research Article

Impact of Scapular Muscle Endurance on Shooting Task in Recreational Basketball Players: A Pilot Study

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ABSTRACT

Background: Scapular stability and endurance are essential components of upper limb biomechanics, particularly in overhead sports such as basketball. Proper functioning of scapular musculature contributes significantly to shoulder kinematics, affecting performance during shooting tasks. Despite this, limited research has explored the direct correlation between scapular muscle endurance and shooting efficiency in recreational basketball players.

Purpose: This pilot study aimed to investigate the relationship between scapular muscle endurance and shooting task in recreational basketball players.

Methods: The study included 12 recreational basketball players, aged 18 to 30 years. The subjects were selected according to inclusion exclusion criteria, each participant's scapular muscle endurance was measured using scapular endurance test measured in kilograms and shooting task was assessed using Standardized shooting task which is 60 free throw attempts, performance was recorded as a percentage. Pearson correlation was used to determine the strength and significance of the relationship between scapular muscle endurance and free throw percentage.

Results: A strong positive correlation was found between scapular muscle endurance and shooting task ($r = 0.988$, $p = 0.0001$). This indicates that higher scapular endurance is strongly associated with improved free throw accuracy.

Conclusion: The results suggest that scapular muscle endurance plays a critical role in shooting task among recreational basketball players. Enhancing scapular endurance could potentially improve shooting accuracy, making it a key focus area in training and rehabilitation programs for athletes in overhead sports.

Keywords: Athletic performances, muscular fatigue, muscle strength, shoulder joint.

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INTRODUCTION

Basketball is both a recreational and competitive sport that promotes health, coordination, alertness, and team spirit. Key skills such as dribbling, passing, shooting, and rebounding require muscular strength, endurance, and

power [1]. As an intermittent high-intensity sport, basketball demands a mix of aerobic and anaerobic fitness, along with attributes like strength, power, speed, agility, flexibility, and sport-specific skills [2].

Scapular and shoulder muscles are essential for basketball actions like shooting, dribbling, rebounding, and blocking. The synchronized movement between the scapula and humerus, known as scapulohumeral rhythm, is essential for smooth arm motion and joint stability. Under normal conditions, the scapula is positioned with approximately 35° of internal rotation and 10° of anterior tilt. Deviations from this can impair shoulder function, leading to excessive internal rotation, reduced rotator cuff strength, external impingement, and increased capsular strain [3,4]. Key stabilizing muscles—trapezius, serratus anterior, rhomboids, and levator scapulae—control scapular positioning during arm movements, supporting joint alignment, force generation, and full range of motion [5].

Insufficient scapular muscle endurance can significantly compromise shoulder mechanics, leading to early muscle fatigue, altered movement patterns, and reduced functional performance. When the scapular stabilizers are unable to maintain proper positioning during repetitive or prolonged activities, compensatory movements may occur, placing excess strain on the shoulder joint and surrounding muscles. This dysfunction can diminish the efficiency and accuracy of upper limb movements, which is particularly detrimental in sports like basketball that demand precision and control. The repetitive overhead and high-velocity arm movements involved in basketball place considerable demands on the shoulder complex and surrounding musculature [6-8].

Research indicates that dysfunction in the scapular muscles may result in improper alignment and impaired function of the upper limb. Kinetic chain dysfunction can result from anatomical disruptions, such as reduced shoulder range of motion. When the kinetic chain is not functioning correctly, the upper extremity tries to “catch up”, which increases the forces on the shoulder and elbow placing players at risk for injury. In overhead athletes the upper extremity initially in external rotation and abduction of the humerus into a semi-cocked position. At peak external rotation, the scapula is fully retracted, laterally rotated, and tilted backward (posteriorly). The rotator cuff activates in concavity compression to maintain the stability of glenohumeral joint [9].

Previous studies have shown a link between scapular muscle endurance and both injury risk and athletic performance. Scapulothoracic muscles have been shown to be prone to fatigue, which is known to affect scapular movement patterns. It has been shown that there is a correlation between altered scapular kinematics and shoulder impingement. Therefore, the assessment of scapular muscle endurance is clinically significant [10].

The overall normal function of the scapula depends greatly depend on the scapular muscle. Sufficient endurance of these muscles is essential in order to maintain a consistent, proper scapula-humeral rhythm throughout prolonged overhead activity. When the scapula is unsuccessful in performing its role in stabilization and in decrease in neuromuscular performance moreover, in condition such as injury where there is a loss in endurance subacromial impingement may occur due to improper scapular rotation [11].

It is appropriate to investigate correlation between scapular muscle endurance and shooting task in recreational basketball players. Therefore, there is a need to investigate the relationship between scapular muscle endurance and shooting task.

METHODS

The research was carried out following an cross sectional study approach. An approval for the study was obtained from the institutional ethical committee. Participants were selected using a convenience sampling technique. All participants were provided with information about the study, and each gave their written consent to take part. The study included recreational basketball players aged between 18 and 30 years, who play at least three times a week, possess a Body Mass Index (BMI)

ranging from 18.5 to 24.5/ kg/m², exhibit normal shoulder range of motion and the study did not include participants with musculoskeletal or neurological impairments and if they had recent fractures in the upper limb.

Procedure: Participants who met the inclusion criteria were selected for the study. A brief introduction about the testing procedure was explained to the subjects. A preliminary assessment was conducted to gather demographic information. Subjects were assessed for scapular muscle endurance using Scapular Muscle Endurance Test (SMET) [9] discussed by Tate et al in 2012.

Standardized shooting task (SST)was assessed by the 60 free throw method evaluating consistency, accuracy, and fatigue resistance during free throw shooting. Before beginning the test, subjects were given a brief introduction about the procedure. The test consisted of 60 consecutive free throw attempts, performed in a standardized indoor basketball setting [13]. The scores obtained by two scales were tabulated and subjected to statistical analysis.

RESULTS

The study included 12 participants. Statistical analysis was done using SPSS20. Descriptive statistics were presented using mean and standard deviation. Correlation of scapular muscle endurance and shooting task was performed using Karl-Pearson's correlation coefficient. A p-value <0.05 was considered statistically significant.

Table 1: Correlation between scapular muscle endurance (kg) and standardized shooting task (%).

	N	Mean	SD	r value	p value
scapular muscle endurance	**12**	0.98	0.2	0.988	0.0001
shooting accuracy	12	43.74	5.05		

DISCUSSION

This study aimed to investigate the relationship between scapular muscle endurance and shooting performance in recreational basketball players. We hypothesized that greater scapular muscle endurance would positively influence shooting task. The scapular stabilizers—primarily the trapezius, serratus anterior, and rhomboids—contribute to dynamic shoulder stability and proper scapulohumeral rhythm during overhead activities [3-5].

Dysfunction or fatigue in these muscles can lead to compensatory movement patterns, resulting in altered kinematics and reduced efficiency [6]. In basketball, where repetitive upper limb actions such as shooting and passing are essential, such inefficiencies can negatively impact performance and increase injury risk.[7,8] Poor endurance of these stabilizers can result in scapular dyskinesis characterized by altered motion patterns such as excessive scapular winging, protraction, or early upward rotation which may compromise the kinetic chain and lead to decreased shooting accuracy.

Since muscle endurance and anaerobic performance can decline with age, the youthful nature of the sample indicates the findings are most relevant to 18–30-year-old basketball players. This strengthens the applicability of their findings to work on scapular muscle endurance and shooting accuracy in basketball players aged 18–30. In the present study, the participants had amean BMI of 22.00/ ±/ 1.572, which falls within the normal weight category. Individuals with a normal BMI exhibit better muscle efficiency and endurance, which reduces mechanical load on the joints and allows for sustained performance during repetitive upper-limb tasks, such as shooting, passing, and defending.

The mean scapular muscle endurance (SME), assessed using push pull hand-held dynamometer, was found to be 0.98±0.20 while shooting accuracy measured using the standardized shooting task (SST) had a mean score of 43.74/ ±/ 5.05%. The strong correlation indicates that scapular muscle endurance plays an important role in determining shooting accuracy among this group of recreational players.

The findings revealed a strong positive correlation (r = 0.988, p = 0.0001), suggesting that higher scapular endurance is significantly associated with improved shooting accuracy. These results support the hypothesis that optimal scapular muscle function plays a

crucial role in the biomechanics of overhead movements like basketball shooting.

Previous literature highlights that fatigue of scapular muscles leads to abnormal kinematics, including increased internal rotation and anterior tilt of the scapula, which can compromise joint integrity and shooting accuracy [3,4,6]. Kibler et al. emphasized that scapular dyskinesis, common among overhead athletes, affects the kinetic chain and leads to decreased neuromuscular performance [3]. Similarly, Oyama et al. identified that scapular dysfunction increases the risk of shoulder injuries in overhead athletes, reinforcing the need for endurance-based scapular training [7].

The findings of the current study are consistent with those reported by Roy et al. [10] who reported that individuals with reduced scapular muscle endurance exhibited poor control during prolonged upper extremity activity. This supports the observed decline in shooting accuracy in players with lower endurance values. Additionally, research by Tate et al. [9] on pitchers noted that fatigue altered scapular mechanics, which mirrors the decline in shooting efficiency under fatigue conditions observed in this study's lower-endurance participants.

Moreover, Ellenbecker and Cools [8] advocate for rehabilitation protocols focusing on scapular endurance to improve performance and reduce impingement-related symptoms in athletes. This perspective aligns with our conclusion that targeted strengthening of scapular muscles could enhance both performance and injury prevention in recreational basketball players.

Although this study was limited by its small sample size, the strength of correlation observed provides compelling evidence to explore this relationship further in larger-scale trials. Given the high reliability of both the Scapular Muscle Endurance Test (SMET) and the Standardized Shooting Task (SST), these tools are appropriate for monitoring functional improvements over time and assessing the effectiveness of targeted training interventions.

CONCLUSION

This pilot study concludes that scapular muscle endurance is strongly and positively correlated with free throw shooting performance in recreational basketball players. Players with higher scapular endurance demonstrated significantly better shooting accuracy, highlighting the critical role of scapular stabilizers in maintaining shoulder mechanics and upper limb function during repetitive shooting tasks. These findings suggest that incorporating scapular endurance training into athletic routines may enhance performance and help prevent shoulder-related injuries, even among non-elite athletes.

ABBREVATION

SME: Scapular muscle endurance
SMET: Scapular muscle endurance test
SST: standardized shooting task

Conflicts of interest: **None**

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