



Shoulder muscle activation during overhead squat: effects of elastic resistance direction on kinetic chain dynamics

Activación muscular del hombro durante lo overhead squat: efectos de la dirección de resistencia elástica en la cadena cinética

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Abstract

Introduction: The overhead squat is a complex movement that engages multiple segments of the kinetic chain. However, the interaction between electromyographic activity and elastic resistance within this context remains insufficiently understood.

Objective: This study examined how different configurations of elastic resistance influence the activation of shoulder and axiohumeral muscles during the OHS.

Methodology: Surface electromyography was used to record muscle activity in 19 healthy male participants, divided into two elastic resistance groups, while performing the OHS under three resistance conditions. Non-parametric statistical analysis were applied.

Results: Significant differences in muscle activation were observed across resistance conditions in both elastic resistance groups. Higher resistance levels were associated with increased activation of the anterior deltoid (AD), upper trapezius (UT), and latissimus dorsi (LD). Activation ratios revealed reduced reliance on prime movers during arm elevation.

Discussion: Elastic resistance effectively modulates shoulder muscle recruitment, particularly enhancing scapular stabilization through greater activation of the lower trapezius and serratus anterior. The latissimus dorsi also contributes to trunk control and energy transfer along the kinetic chain.

Conclusions: Findings support integrating resistance direction and magnitude into rehabilitation strategies to optimize neuromuscular control in individuals with shoulder dysfunction.

Keywords

Shoulder; electromyography; superficial back muscles; rehabilitation; elastic resistance training.

Resumen

Introducción: La sentadilla con barra sobre la cabeza es un movimiento complejo que involucra múltiples segmentos de la cadena cinética. Sin embargo, la interacción entre la actividad electromiográfica y la resistencia elástica en este contexto aún no se comprende del todo.

Objetivo: Este estudio examinó cómo diferentes configuraciones de resistencia elástica influyen en la activación de los músculos del hombro y axiohumeral durante la sentadilla con barra sobre la cabeza.

Metodología: Se utilizó electromiografía de superficie para registrar la actividad muscular en 19 participantes varones sanos, divididos en dos grupos de resistencia elástica, mientras realizaban la prueba de resistencia en tres condiciones de resistencia. Se aplicó un análisis estadístico no paramétrico.

Resultados: Se observaron diferencias significativas en la activación muscular en las diferentes condiciones de resistencia en ambos grupos de resistencia elástica. Los niveles más altos de resistencia se asociaron con una mayor activación del deltoides anterior (AD), el trapecio superior (UT) y el dorsal ancho (LD). Las tasas de activación revelaron una menor dependencia de los músculos principales durante la elevación del brazo.

Discusión: La resistencia elástica modula eficazmente el reclutamiento muscular del hombro, mejorando en particular la estabilización escapular mediante una mayor activación del trapecio inferior y el serrato anterior. El dorsal ancho también contribuye al control del tronco y a la transferencia de energía a lo largo de la cadena cinética.

Conclusiones: Los hallazgos respaldan la integración de la dirección y la magnitud de la resistencia en las estrategias de rehabilitación para optimizar el control neuromuscular en personas con disfunción del hombro.

Palabras clave

Hombro; electromiografía; músculos superficiales de la espalda; rehabilitación; entrenamiento de resistencia elástica.

Introduction

The shoulder complex exhibits exceptional mobility, which demands precise muscular coordination to maintain joint stability, particularly during overhead movements. Within this system, the scapula plays a critical role in preserving optimal humeral head positioning throughout motion (Castelein et al., 2017; Zaremski et al., 2017) and serves as a central link in the kinetic chain (KC), transferring forces between the lower and upper limbs (Borms et al., 2020; De Mey et al., 2013). During the overhead squat (OHS), stability is first established in the lower extremities, force is generated through the core in a closed-chain manner, and this force is subsequently transmitted through a stabilized scapula and shoulder to the upper limbs. Thus, efficient shoulder function depends on the coordinated interaction of prime movers and scapular stabilizers.

Functionally, the shoulder musculature can be divided into three synergistic groups: (1) scapulohumeral muscles, including the anterior (AD) and middle (MD) deltoid, responsible for humerus motion relative to the scapula; (2) axioscapular muscles, such as the upper (UT) and lower (LT) trapezius and the serratus anterior (SA), which control scapular positioning relative to the trunk; and (3) axiohumeral muscles, notably the latissimus dorsi (LD), which connect the trunk to the humerus. The rotator cuff muscles further contribute to dynamic stabilization and are often the focus of preventive and rehabilitative programs. Although the LD primarily acts as a prime mover and antagonist during arm elevation, it also supports trunk posture and scapulothoracic control along the KC (Miyakoshi et al., 2019; Myers et al., 2001).

Selective muscle activation and targeted strengthening are fundamental strategies in shoulder rehabilitation. Traditional resistance exercises typically employ unidirectional loading, performed either in isolation (Haberle et al., 2018; Haraldsson et al., 2021) or integrated within the KC (Borms et al., 2022; Borms et al., 2020; De Mey et al., 2013; Wasserberger et al., 2020). However, the influence of elastic resistance applied in multiple directions within the KC remains underexplored, particularly regarding its effect on shoulder muscle recruitment and coordination. Understanding these effects is essential for designing exercises tailored to specific rehabilitation phases and optimizing scapular muscle performance.

KC-based and resistance-integrated exercises are increasingly used in rehabilitation programs because they enhance proprioception, neuromuscular, and coordinated coactivation patterns (Andrade et al., 2011; Castelein et al., 2017; De Mey et al., 2013; Richardson et al., 2020; Wasserberger et al., 2020). Evidence suggests that elastic or progressive resistance can improve muscle recruitment efficiency, leading to better joint control and functional performance (De Mey et al., 2013; Wasserberger et al., 2020). Nonetheless, the mechanisms underlying shoulder muscle recruitment, force transmission from limbs, and optimal strategies for restoring stability and preventing injury remain insufficiently understood (Richardson et al., 2020).

Despite growing interest, the impact of elastic resistance during vertical movement within the KC on shoulder muscle activation has not been fully elucidated. Trunk positioning significantly affects scapular kinematics and muscle activity (Miyakoshi et al., 2019), yet its interaction with resistance direction during the OHS is poorly characterized. Although rehabilitation often seeks to balance mobility and stability, the dynamic interplay between these components (mobility on stability) required further investigation.

Building upon the kinematic findings by Salles and Pascoal (2025) which demonstrated that external resistance during the OHS enhances scapular alignment and movement adaptation, the present study aims to extend this understanding by examining the neuromuscular mechanisms underlying these adaptations. Specifically, this study investigates how different configurations of elastic resistance influence shoulder and axiohumeral muscles activation during the OHS. Based on previous kinematic improvements, we hypothesize that (H1) distinct configurations of elastic resistance will elicit specific muscle patterns during arm elevation, with axioscapular muscles showing greater activation than scapulohumeral and axiohumeral muscles; and (H2) variations in resistance direction and magnitude will produce distinct intermuscular activation ratios, reflecting adaptive neuromuscular strategies that maintain scapular stability and optimize KC efficiency under load.

Method

Participants

The study involved nineteen healthy young adults, aged between 20 and 23 years [age = mean (SD) 21.9 (3.7) years; height = 175.7 (6.2) cm; weight = 80 (13.9) kg; and Body Mass Index (BMI) = 25.2 (4.2) kg/m²] recruited through convenience sampling. Eligibility criteria required participants to be free from shoulder or neck complaints in the previous six months and no prior history of shoulder fractures or surgeries. To rule out lower limb KC alterations that could affect study outcomes, participants were screened using the lunge (Hoch et al., 2015; Hoch & McKeon, 2011) and step-down tests (Park et al., 2013). All participants received detailed information about the study procedures and provided written consent. The study protocol was approved by the University's Institutional Review Board (CEIFMH n°: 45/2021; Approval Date: 3 November 2021) and adhered to the principles of the Declaration of Helsinki and Human Subjects Research Guidelines.

Procedure

Instrument and Data collection

Surface electromyography (sEMG) and triaxial accelerometry were recorded using a Delsys EMG Trigno™ Wireless System (Delsys Inc., USA). EMG signals were acquired using surface electrodes and wirelessly transmitted to the acquisition software (EMGworks® Analysis), then exported for further processing and analysis in MATLAB (R2022b, MathWorks, Natick, MA, USA). The sampling rates were 1926 Hz for EMG and 148 Hz for accelerometry. Electrode placement followed the recommendations of SENIAM (Hermens et al., 2000), and signal acquisition was limited to the right side of the body (Table 1).

Table 1. Electromyography electrode positions for the muscles analyzed in this study.

| Muscle | Electrodes position |
|------------------------|--|
| Anterior Deltoid (AD) | One finger width distal and anterior to the acromion. |
| Middle Deltoid (MD) | From the acromion to the lateral epicondyle of the elbow. |
| Upper trapezius (UT) | Halfway on the line from the acromion to C7. |
| Lower trapezius (LT) | At 2/3 on the line from the scapula spine to T8. |
| Serratus anterior (SA) | On the lateral border of the chest anterior to the latissimus dorsi and posterior to the pectoralis major (Maenhout et al., 2010). |
| Latissimus dorsi (LD) | At T12 level and along a line connecting the most superior point of the posterior axillary fold (Wasserberger et al., 2020). |

Source: own elaboration.

A six-degree-of-freedom electromagnetic tracking device (FASTRACK™, Polhemus, Colchester, VT, USA) was used in conjunction with MotionMonitor™ software (Motion Monitor V9, Innovative Sports Training, Chicago, IL, USA) to record the three-dimensional (3D) position and orientation of the thorax and shoulder at a sampling frequency of 30 Hz. The kinematic recording and analysis procedures were identical to those described by Salles and Pascoal (2025) and followed the recommendations of the International Society of Biomechanics (Wu et al., 2005).

Experimental procedure



Before the start of the experimental protocol, participants performed maximal voluntary isometric contractions (MVIC), assessed by the same researcher. For this test, participants were seated with their spines erect, their arms positioned at 90° in the scapular plane, and their thumbs facing upward (Castelein et al., 2015). Manual resistance was applied in the directions of shoulder depression, horizontal adduction, and internal rotation. Participants were instructed to hold the position for 10 seconds while exerting maximal effort, with standardized verbal encouragement provided throughout. A two-minute rest interval followed each MVIC measurement.

Kinematic and sEMG data were collected during five repetitions of a bilateral upper-limb elevation-depression task performed concurrently with a squat-return motion. Participants began in a standing with their arms relaxed at their sides. The task involved synchronous arm elevation and squat descent to maximum depth, followed by a return to the initial position via arm lowering and hip/knee extension (Figure 1). The task was performed under three resistance conditions: no elastic resistance (R00), elastic resistance applied from the feet to the upper limbs (R01), and elastic resistance applied between the upper and lower limbs (R02).

Figure 1. Initial and final positions of the overhead squat exercise under three resistance conditions: no elastic resistance (R00); elastic resistance from feet to upper limbs (R01); and elastic resistance between upper and lower limbs (R02).



Source: own elaboration.

Participants were randomly assigned to one of two groups based on the elastic CLX TheraBand® (TheraBand®, Performance Health, Akron, OH, USA) used: LT-B (Low Tension; Blue TheraBand) and HT-B (High Tension; Black TheraBand).

The analysis was limited to the concentric phase (loading phase) of the movement, where the arm movement occurs against external resistance. In the R00 conditions, gravity was the sole external load; in the R01 and R02 conditions, resistance resulted from the combination of gravity and elastic band tension.

To ensure standardized execution, participants received visual and verbal instructions (Coyne et al., 2021). They were instructed to stand with their feet aligned with the anterior superior iliac spine and maintain a straight back and perform the squat symmetrically during both descent and ascent. During the descent, participants raised their arms until they aligned with the trunk, while during the ascent, they returned to the starting position.

Signal processing and Data analysis

The sEMG signals were processed in a standardized manner before extracting the variables of interest. For each resistance condition, the five central repetitions were selected for analysis. The signal recorded during the MVIC tests and experimental trials was initially subjected to 3rd-order Butterworth bandpass filtering (20-300 Hz) and then to full-wave rectification. Base noise was removed by subtracting the average of the rectified signal obtained during a pre-task rest period.

Subsequently, a linear envelope was obtained through 3rd-order Butterworth low-pass filtering (2 Hz). All sEMG sessions were visually inspected by an experienced evaluator to ensure signal quality and identify artifacts. Any artifacts were excluded from the analysis.

To allow comparisons between participants and conditions, the signals were normalized to the peak obtained in the MVIC test of each muscle, being expressed as a percentage of maximum activation (%MVIC). Muscle activation levels were classified according to established criteria (Wattanaprakornkul et al., 2011): minimal activation (<10% MVC); low activation (10–25% MVC); moderate activation (26–50% MVC); high activation (>50% MVC).

Selecting appropriate exercises to restore the intramuscular balance of the shoulder muscles is essential from a clinical point of view (Borms et al., 2020). Therefore, scapular muscle ratios were calculated by dividing the normalized EMG activity of the LT (UT: LT ratio), or the SA (UT: SA ratio), and for the DA (DA: LD ratio), the DA (DA: UT ratio), the DM (DM: LD ratio), the UT (UT: LD ratio), and the LT (LT: LD ratio).

Temporal normalization was performed by resampling each movement cycle to 101 points (0–100% of the cycle). Muscle activation and intramuscular ratio were analyzed in four shoulder elevation angle ranges: 0–30°, 30–60°, 60–90°, and 90–120°.

Statistical analysis

Statistical analysis was performed using IBM SPSS (version 30, IBM Corp., Armonk, NY, USA). The independent variables included TheraBand® type (LT-B vs. HT-B), resistance conditions (R00, R01, R02). The dependent variables include muscle activity and activation ratios, calculated from five repetitions per condition. For each participant and condition, the median of the five repetitions was used in the analysis. The arm elevation angles (intervals) were used as analysis windows.

The normality of the dependent variables was assessed using the Shapiro-Wilk test. As the assumptions for the parametric test were not met, non-parametric statistics methods were applied. The Friedman test was used to analyze the dependent and independent variables. Post hoc analysis used the Wilcoxon test to compare differences between resistance conditions with the Bonferroni correction. Between-group comparisons (LT-R vs. HT-B) were performed using the Mann-Whitney test.

Results

The elastic resistance groups revealed significant differences in muscle activation and intramuscular balance across arm elevation angle intervals ($p < .05$).

Effect of elastic resistance

Muscle activation

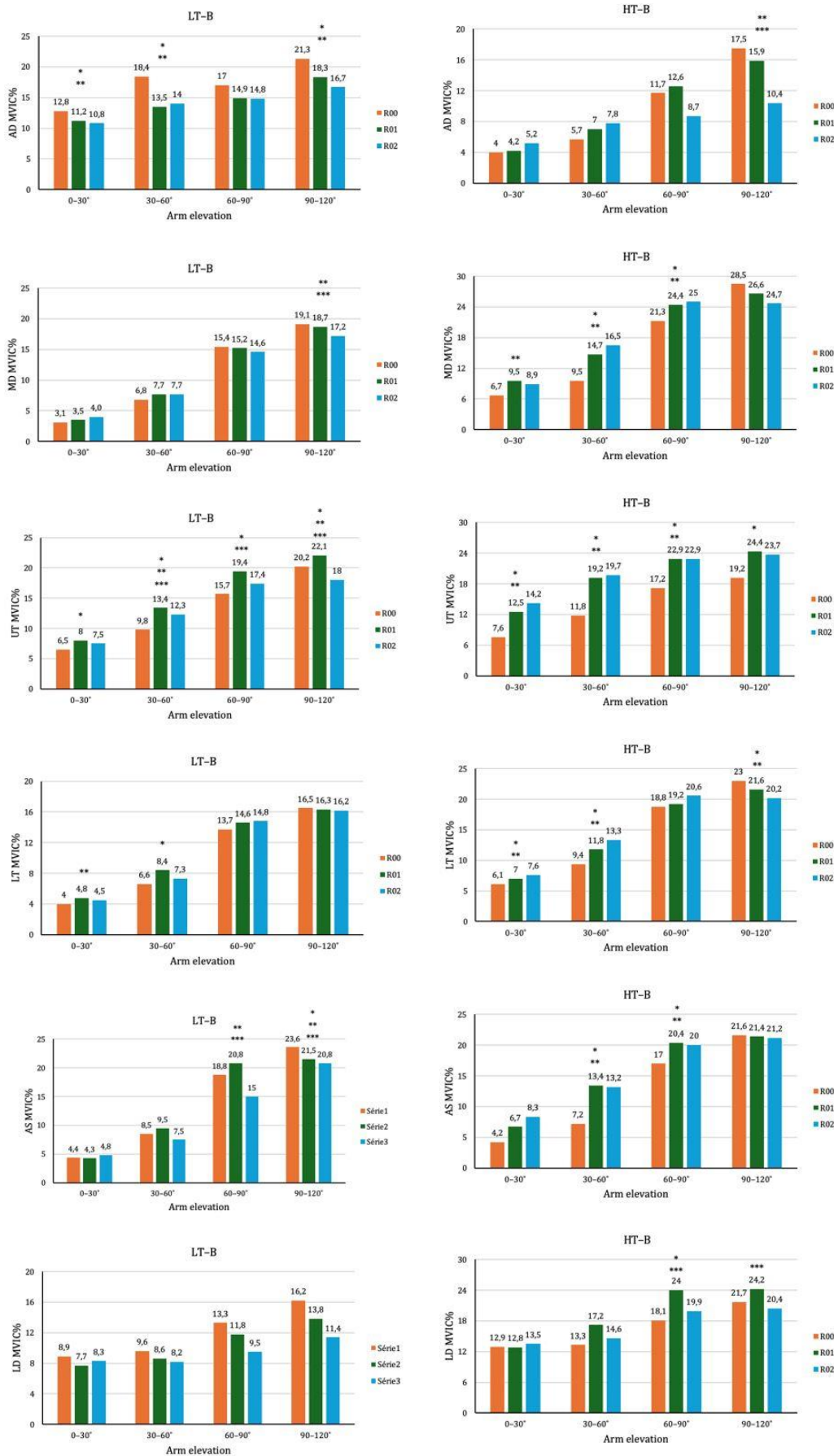
The muscle activation comparison across the three resistance conditions within each TheraBand® group is shown in Table 2 (see supplementary material). In the LT-B group, significant differences were observed in AD activation at 0–30°, 30–60°, and 90–120°. The MD showed significant differences at 0–30°, 60–90°, and 90–120°. UT activation increases significantly across all angle intervals. The LT differed significantly at 0–30° and 30–60°, while SA showed significant differences from 30–60° to 90–120°. The LD muscle did not differ significantly across intervals.

In the HT-B group, the AD activation differed only at 90–120°, while the MD showed significant increases in activation from 0–30° to 60–90°. The UT and LT muscles showed significant differences at

most intervals. SA activation differed from 0–30° to 60–90°, and LD activation was significantly different at 60–90° and 90–120°.

Post hoc analyses revealed significant differences in muscle activation across resistance conditions for several muscles and joint-angle intervals, with moderate-to-large effect sizes, as shown in Figure 2 (Table 3, see supplementary material). In the LT-B group, the R00 exhibited higher values than R01 and R02, and R01 was greater than R02. In contrast, LD muscle activation did not differ across conditions. In the HT-B group, R01 and R02 showed higher values than R00, and R01 was again greater than R02.

Figure 2. Muscle activation differences between resistance conditions by group: Bonferroni-adjusted Post Hoc analysis. Significant muscle activation differences are in brackets.



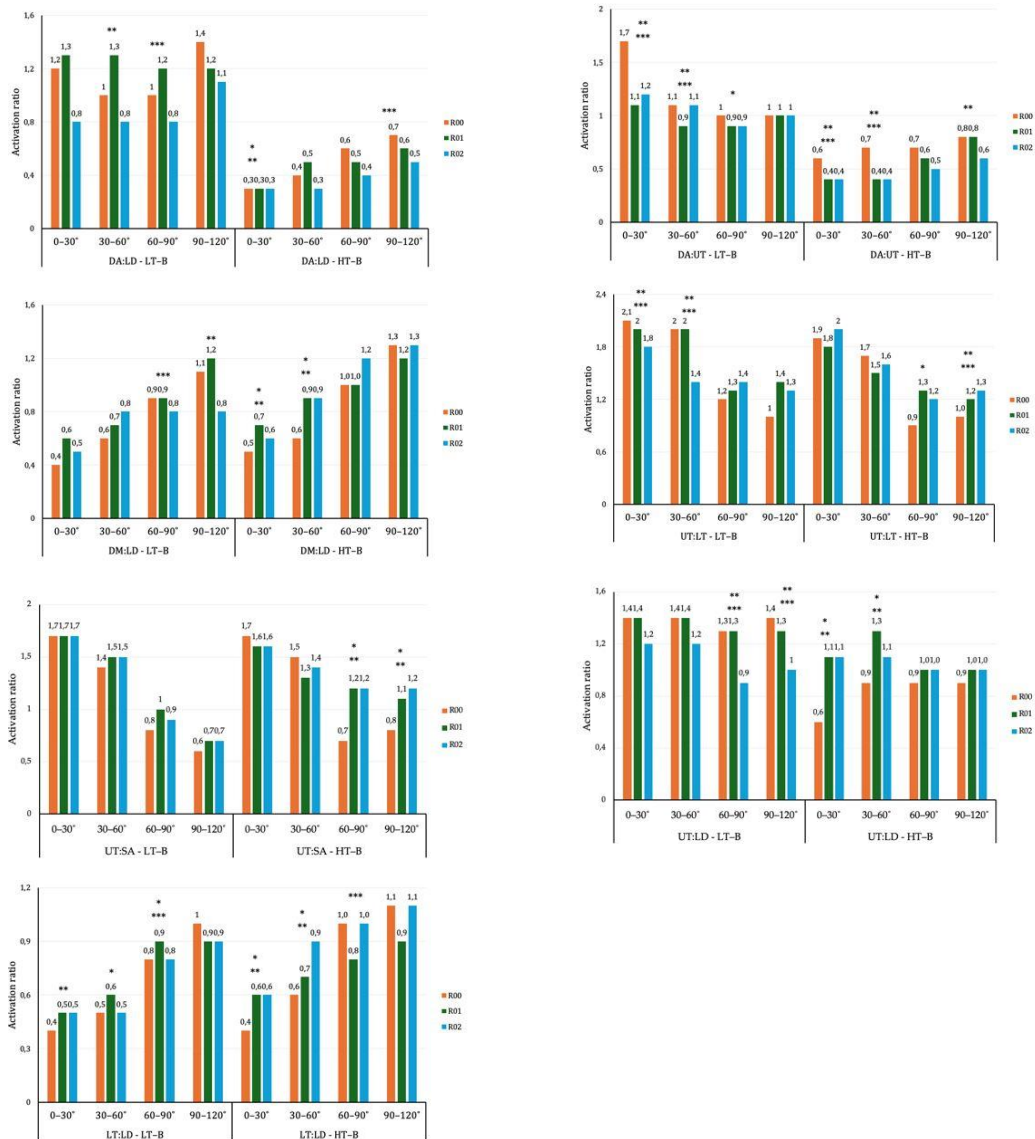
Activation ratios

The activation ratios for different arm elevation intervals and resistance conditions, for the LT-B and HT-B groups, are shown in Table 4 (see supplementary material). In the LT-B group, significant differences were found for several ratios: AD:LD (30-60° and 60-90°), AD:UT (0-30° to 60-90°), MD:LD (60-90° and 90-120°), UT:LT (0-30° and 30-60°), UT:LD (60-90° and 90-120°), and LT:LD (0-30° to 60-90°). The UT:SA ratio did not differ significantly.

In the HT-B group, significant changes were observed in the AD:LD (0-30° and 90-120°), AD:UT (0-30° to 90-120°), MD:LD (0-30° to 90-120°), UT:LT and UT:SA (60-90° and 90-120°), UT:LD (0-30° and 30-60°), and LT:LD ratio (0-30° to 60-90°).

Post hoc comparisons indicated significant differences in muscle activation ratios across resistance conditions and joint angle intervals, with effect sizes ranging from low to large, as shown in Figure 3 (Table 5, see supplementary material).

Figure 3. Activation ratio differences between resistance conditions by group: Bonferroni-adjusted Post Hoc analysis. Significant muscle activation differences are in brackets.



Discussion

A prior kinematic analysis revealed significant alterations in scapular motion between 30° and 60° range of arm elevation (Salles & Pascoal, 2025). Specifically, the scapular upward rotation was greater in the R00 condition, whereas scapular internal rotation was more pronounced in R01 and R02. Scapular posterior tilt was higher in R01 at 30°, and both R00 and R01 showed increased tilt at 45°, compared to R02. Together, these findings indicate that resistance application modulates scapular control strategies, particularly within the mid-range of humeral elevation. The R01 condition, characterized by a vertically oriented force vector, appears to increase the demand for posterior tilt and internal rotation to stabilize the scapula. In contrast, the R02 condition, with its alignment more closely following the body axis, may challenge scapular control in a different plane, thereby reducing the need for posterior tilting.

The present results highlight complex interactions between scapular kinematics, muscle activation, and intermuscular balance. These patterns reflect neuromuscular coordination strategies required to maintain scapulothoracic control during arm elevation, ensuring effective regulation of the scapulohumeral rhythm and adaptation to changing mechanical demands (Ludewig & Braman, 2011). Muscle activation increased progressively across resistance levels, with higher overall values in the HT-B group. This agrees with previous studies showing that KC exercises elicit low-to-moderate activation levels (Oliver et al., 2016), typically within the 20–30% MVIC range considered adequate for strengthening (Kibler et al., 2008).

Findings on sEMG further support and contextualize the interpretation of the kinematics. UT activation was significantly higher in R01 and R02, particularly in R01, indicating greater recruitment of this muscle under vertical resistance conditions. The concurrent increase in scapular internal rotation supports the UT's dominance contribution during scaption and the increased LT recruitment when external rotation is emphasized (Castelein et al., 2017). Both LT and SA muscles exhibited elevated activation in R01 and R02 compared to R00, suggesting enhanced engagement of scapular stabilizers under KC conditions (Kaur et al., 2020). In particular, the R01 configuration appeared more effective in eliciting SA activation, reinforcing its clinical value in shoulder rehabilitation programs.

These results emphasize the functional role of scapular stabilizers, particularly the LT and SA, during KC exercises. During overhead tasks, effective activation of these muscles is essential to promote scapular upward rotation and posterior tilt, optimizing glenohumeral alignment and reducing subacromial compression risk (Kibler et al., 2001). Neuromuscular deficits in these muscles can lead to altered movement patterns and increased injury risk (Cools et al., 2007). The activation patterns observed in the present study support the integrated function of periscapular muscles in shoulder stabilization, consistent with prior evidence showing optimal recruitment under load (Reed et al., 2016; Werin et al., 2020).

An important finding was the dissociation between scapular motion and muscle activation in the 0–30° and 60–120° elevation ranges, where kinematics remained stable despite significant EMG differences. This suggests that neuromuscular adjustments may occur without visible joint motion changes, reflecting synergistic or compensatory mechanisms aimed at maintaining stability. For instance, alterations in AD activity may indicate reduced reliance on the prime mover due to enhanced proximal stabilization. Clinically, this underscores the value of assessing both EMG and kinematics parameters when designing and evaluating KC exercises.

Therapists should therefore consider resistance direction and magnitude to target key stabilizers such as LT and SA selectively. Adjusting resistance vectors can minimize compensatory patterns, enhance balanced neuromuscular control, and optimize scapular mechanics. Tailoring these parameters to the movement phase and individual muscle activation profiles (e.g., HT-B vs. LT-B configurations) may improve rehabilitation outcomes, especially in individuals with scapular dyskinesis or glenohumeral instability.

The LD muscle, primarily involved in trunk stabilization and scapular control, showed no significant activation changes in the LT-B group, possibly reflecting a low-resistance stabilization strategy. Nonetheless, in tasks such as the OHS, robust activation of both AD and LD muscles is essential for effective load transfer along the posterior chain (Carvalhais et al., 2013; Mohamed et al., 2022). Increased LD activation observed in individuals with back pain (Laudner & Williams, 2013; Mohamed



et al., 2022), along with its role in scapular control, further supports its relevance for kinetic chain assessments.

Overall, resistance configuration influenced both muscle recruitment and scapular kinematics in distinct ways. Specifically, R01 was most effective in eliciting scapular adjustments, particularly posterior tilt and SA activation, supporting its potential in restoring dynamic scapular control. In contrast, R02 also induced adaptations but was less effective in targeting posterior tilt. These results partially confirm Hypothesis 1, indicating that axioscapular muscles exhibited greater activation than the scapulohumeral or axiohumeral groups.

Muscle ratios analysis further clarified neuromuscular strategies. In the LT-B group, higher resistance conditions produced increased AD:LD and AD:UT ratios, indicating enhanced posterior chain engagement and increased UT participation in scapular stabilization. Additionally, the UT:LT ratio decreased under R02, while the UT:SA ratio remained stable, suggesting proportional coactivation between these stabilizers. The interplay between LD, UT, and LT highlights a coordinated posterior stabilization strategy during early and mid-range arm elevation.

Compared to previous studies using linear resistance, which often report increased UT:LT ratios without proportional stabilizer recruitment (Borms et al., 2020; Kara et al., 2019), the present findings suggest that progressive elastic resistance promotes more balanced stabilizer muscle activation. This was particularly evident in R01, which facilitated gradual UT activation increases and adaptive shifts in muscle ratios, indicative of refined motor control strategies. These findings support Hypothesis 2, reinforcing that resistance direction directly affects intermuscular coordination and KC efficiency.

The observed neuromuscular and kinematic adaptations confirm that resistance dynamics play a central role in modulating upper limb elevation. Selective recruitment of LT and SA, combined with increased scapular posterior tilt and internal rotation, reflects the system's capacity for proximal stabilization under-load. Elevated LD activation in the HT-B group at higher elevation angles further emphasizes the thoracolumbar region's contribution to force transmission and scapular control (Bautista et al., 2020; Miyakoshi et al., 2019). Collectively, these findings underscore the clinical relevance of kinetic chain-based strategies for optimizing shoulder rehabilitation and motor control.

Clinical implications

Both the magnitude and direction of elastic resistance influence shoulder muscle activation patterns and intermuscular coordination. Ratios involving LT and LD were particularly sensitive to changes in elevation angles and load, suggesting they are valuable targets for individualized therapeutic interventions. Understanding these neuromuscular interactions may inform the design of tailored rehabilitation programs to improve scapular control and overall shoulder function in patients with dysfunction.

Limitations

This study has several limitations. First, the sample consisted of healthy young males, limiting generalizability to other populations or clinical groups. Second, this study is limited by the lack of control over the speed of movement execution. Variations in speed can alter the pattern of muscle activation and, therefore, should be considered when interpreting the results. Third, the use of surface EMG presents inherent limitations in signal specificity and may not capture deeper muscle activity.

Future directions

Future research should include larger and more diverse cohorts and examine individuals with shoulder pathologies to expand clinical applications. Studies should also investigate a broader range of resistance levels and longitudinal designs to evaluate training adaptations over time. Finally, integrating elastic resistance with manual therapy, proprioceptive training, or neuromuscular reeducation may further enhance outcomes in shoulder rehabilitation.

Conclusions

Overall, the findings demonstrate that progressive external load with elastic resistance effectively modulates shoulder muscle activation patterns, particularly by enhancing scapular stabilization strategies essential for maintaining kinematic integrity during overhead movements. Coordinated activation of key stabilizers, namely the LT and SA, facilitate optimal scapulothoracic mechanics and support efficient shoulder motion under-load. Additionally, LD contributes to trunk stabilization and KC energy transfer, reinforcing its importance in proximal control. These results emphasize the need to consider both the magnitude and direction of resistance when designing rehabilitation protocols to optimize neuromuscular coordination and improve functional outcomes in individuals with shoulder dysfunction.

Financing

This study received no external funding.

Supplementary Material

Supplementary tables supporting the findings of this study are available online at: [<https://www.dropbox.com/scl/fo/p8vclfulbbm0p2ihnel6v/AIKW9juHm2GdyLbn9E7RpEY?rlkey=180ta5qqdx46gm3kut9zn7ru3&st=bw5cqdne&dl=0>].

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