IJBPAS, June, 2026, 15(6): 2613-2623

ISSN: 2277–4998

International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

# EFFECTS OF CORE STRENGTHENING AND SHOULDER STABILIZATION EXERCISES ON SHOULDER FUNCTION AND SHOULDER DISABILITY IN COLLEGE STUDENTS WITH ROUNDED SHOULDER POSTURE

**FALGUNI P[1], MEGHAVI O[2*] AND GOURAV P[3]**

**1:** 2nd year, Master in Physiotherapy, Department of Musculoskeletal and sports, Ahmedabad Physiotherapy College, Parul University, Gujarat, India

**2:** Associate Professor, Master in Women's Health, Ahmedabad Physiotherapy College, Parul University, Gujarat, India; Orchid Id: 0000-0001-9808-4019

**3:** Principal, Master in Neuroscience, Ahmedabad Physiotherapy College, Parul University, Gujarat, India

***Corresponding Author: Dr. Meghavi Oza: E Mail:** meghaviozaapc@paruluniversity.ac.in

**Received 4th May 2025; Revised 5th July 2025; Accepted 2nd Sept. 2025; Available online 1st June 2026**

https://doi.org/10.31032/IJBPAS/2026/15.6.10226

## ABSTRACT

**Background:** Rounded Shoulder Posture (RSP) is common among college students due to sedentary lifestyles and poor posture. It often leads to shoulder pain and dysfunction from muscle imbalances and altered biomechanics. While core strengthening and shoulder stabilization exercises are both used to improve posture and function, their comparative effectiveness in non-athletic populations remains uncertain.

**Objective:** To compare the effects of core strengthening exercises and shoulder stabilization exercises on shoulder pain and disability in college students with RSP using the Numerical Pain Rating Scale (NPRS) and Shoulder Pain and Disability Index (SPADI).

**Methods:** A total of 40 college students with clinically identified RSP were randomly divided into two groups of 20 each. Group A underwent core strengthening exercises, and Group B received shoulder stabilization exercises over 4 weeks (3 sessions/week). Outcome measures included NPRS for pain and SPADI for shoulder function and disability. Pre- and post-intervention scores were statistically analyzed using paired and unpaired t-tests.

**Results:** Both groups showed significant within-group improvements in NPRS and SPADI scores ($p < 0.001$). However, no statistically significant difference was observed between the groups for either outcome measure (NPRS $p = 0.1254$; SPADI $p = 0.2534$), indicating comparable effectiveness.

**Conclusion:** Both core strengthening and shoulder stabilization exercises effectively reduce shoulder pain and improve function in college students with RSP. These findings suggest that either intervention can be incorporated into postural rehabilitation programs for young adults. Further studies with larger samples and combined protocols are recommended to optimize treatment strategies.

**Keywords: Rounded Shoulder Posture, Core Strengthening, Shoulder Stabilization, College Students, Shoulder Pain, SPADI, NPRS**

## INTRODUCTION:

Rounded Shoulder Posture (RSP) is a common postural deviation observed in modern sedentary populations, particularly among college students. It is characterized anatomically by anterior displacement of the acromion process, protraction of the scapula, internal rotation of the humerus, and increased thoracic kyphosis. These postural changes result from prolonged forward-flexed positions—such as sitting at desks, studying, or using digital devices—and contribute to dysfunction in the shoulder girdle and upper spine **[1, 2]**.

The rapid shift towards sedentary academic lifestyles combined with extensive use of smartphones and laptops has contributed significantly to the rise of this condition. A study by Singh and Sharma (2021) reported that approximately 48% of Indian college students demonstrated RSP, with prolonged sitting and poor ergonomic practices identified as primary risk factors **[3]**. Another investigation conducted by Gupta *et al*. (2023) in a North Indian university population found a prevalence of 44%, correlating RSP with symptoms of neck pain and shoulder discomfort **[4]**.

RSP involves tightness in the pectoralis major and minor, upper trapezius, and levator scapulae, with corresponding weakness or lengthening of the rhomboids, middle and lower trapezius, and serratus anterior. The scapula may rest in a downwardly rotated, protracted, and anteriorly tilted position. These muscular imbalances lead to abnormal scapulohumeral rhythm, reduced glenohumeral joint congruency, and limited shoulder range of motion **[5]**. These changes can impair neuromuscular control, reduce proprioception, and alter normal activation timing of the scapular stabilizers. Over time, these deficits may contribute to soft tissue strain, shoulder impingement syndrome, and

even rotator cuff dysfunction **[6]**. Addressing these neuromuscular deficits is essential for restoring function and preventing chronic dysfunction.

Shoulder movement depends on proper coordination between the glenohumeral joint and the scapulothoracic articulation. In RSP, this kinetic chain is disrupted. During overhead movements, a poorly stabilized scapula cannot adequately upwardly rotate, resulting in increased stress on the subacromial space and tendinous structures. Additionally, core instability can impair the transfer of force from the lower body to the upper extremity during functional activities such as lifting, reaching, or throwing **[7]**.

Core strength provides a proximal base for distal mobility. The lumbopelvic region acts as a dynamic stabilizer that influences upper limb function through kinetic chain linkages. A weak or poorly coordinated core compromises trunk stability, leading to compensatory strategies that can overburden the shoulder complex. Conversely, proper core engagement can improve shoulder biomechanics by enhancing postural alignment and force transmission **[8]**.

Two widely used intervention strategies for correcting RSP and improving shoulder function are core strengthening and shoulder stabilization exercises. Core strengthening targets the transversus abdominis, multifidus, obliques, and erector spinae to improve postural support and trunk control. Studies have demonstrated that these exercises enhance functional performance and posture in individuals with musculoskeletal disorders **[9]**. Shoulder stabilization exercises, in contrast, focus on improving scapular muscle function, especially the serratus anterior, middle/lower trapezius, and rhomboids. These exercises aim to restore proper scapular alignment, improve shoulder stability, and reduce compensatory muscle activity **[10]**.

However, limited studies have compared the effects of these two approaches—particularly in young, sedentary populations like college students who are at high risk for developing RSP.

**Objective of the Study**

To compare the effects of core strengthening and shoulder stabilization exercises on shoulder function and shoulder disability in college students with rounded shoulder posture

- To assess the effect of core strengthening exercises and Shoulder Stabilization exercises on Shoulder pain by using the NPRS.
- To assess the effect of core strengthening exercises and Shoulder Stabilization exercises on Shoulder function and disability by using the SPADI.

- To compare the improvement in shoulder pain by NPRS and Shoulder function and disability by using the SPADI following core strengthening exercises versus shoulder stabilization exercises in college students with rounded shoulder posture.

**MATERIALS AND METHODS:**

**Study design:** Comparative study to evaluate the effects of core strengthening exercises versus shoulder stabilization exercises on shoulder function and disability in college students with Rounded Shoulder Posture (RSP).

**Study Population:** The study population consisted of college-going students having with RSP.

**Sample Size:** A total of 40 subjects were recruited and randomly divided into two equal groups of 20 subjects each. Group A underwent core strengthening exercises, while Group B received shoulder stabilization exercises.

Site and Source of the Study: The study was conducted at Ahmedabad Physiotherapy College, utilizing its facilities and resources for recruitment and intervention.

**Materials Used:** Standard physiotherapy equipment was used during the exercise sessions, including resistance bands, exercise mats, and dumbbells. The source of these materials was the Ahmedabad Physiotherapy College's clinical OPD.

**Inclusion criteria:**

- Male and female
- College going students with rounded shoulder
- 18-25 years of age
- Consent to participate

**Exclusion criteria:**

- Any History of musculoskeletal diseases, neurological diseases, cardiopulmonary diseases
- History of surgery that could affect the experiment.
- Congenital neck and shoulder deformities
- Recent fracture

**Outcome Measures**

Two validated outcome measures were employed to assess changes in shoulder pain, function, and disability:

- Numerical Pain Rating Scale (NPRS): NPRS is a simple, reliable, and valid tool for measuring pain intensity (0–10 scale), widely used in musculoskeletal research with high test-retest reliability (ICC > 0.85) **[11, 12]**.
- Shoulder Pain and Disability Index (SPADI): SPADI is a validated, gold-standard questionnaire for assessing shoulder pain and disability, with strong internal consistency (α >

0.90) and excellent reliability (ICC 0.90–0.95) **[13, 14]**.

**Intervention:**

**Duration and Frequency:** The intervention was carried out over a period of 4 weeks, with exercise sessions conducted 3 times a week. Each session lasted approximately 30 minutes, ensuring adequate intensity and duration to produce measurable outcomes.

All participants began and ended each session with a standardized 5-minute warm-up and cool-down routine to prepare the body and facilitate recovery. The warm-up included gentle stretching and rotational exercises targeting the neck, wrists, pelvis, knees, and ankles, while the cool-down incorporated similar neck, wrist, and ankle rotations along with controlled breathing exercises to promote relaxation.

| EXERCISES GROUP A | |
|---|---|
| Bridge exercise | 1st and 2nd week for 10 sec 5 times 3 sets |
| Quadruped with alternate arm and leg raises | |
| Diagonal abdominal curl-up exercise | |
| Back extension exercise | |
| Bridge exercise using a foam roll | 3rd and 4th week fot 10 sec 5 times 3 sets |
| Diagonal abdominal curl-up exercise using a foam roll | |
| Back extension exercise using a foam roll | |
| Quadruped with alternate arm and leg raises using a foam roll | |
| **EXERCISES GROUP B** | **Repetitions** |
| Y to W exercise | 10 sec 5 times 3 sets |
| L to Y exercise | 10 sec 5 times 3 sets |
| Shoulder retraction with theraband | 10 sec 5 times 3 sets |
| Resisted shoulder external rotation with a band from 45 degrees to 60 degrees with elbows flexed in 90 degrees. | 10 sec 5 times 3 sets |
| Resisted “rowing” shoulder extension with elbow flexion with a band fixed on feet in long sitting position. | 10 sec 5 times 3 sets |
| Resisted “rowing” shoulder extension with elbow flexion towards abdo men with a band fixed on feet in mini squat position. | 10 sec 5 times 3 sets |

**Procedure**:

- The study was conducted after obtaining ethical clearance from the Institutional Ethics Committee of Ahmedabad Physiotherapy College.
- Participants were recruited based on predefined inclusion and exclusion criteria.
- Prior to enrolment, all eligible subjects were provided with detailed information regarding the study’s purpose, procedures, potential benefits, and possible risks.
- Written informed consent was obtained from each participant before the initiation of any study-related procedures.
- Following the screening process, eligible participants were randomly allocated into two groups of 20

participants each: Group A (Core Strengthening Group) and Group B (Shoulder Stabilization Group) using a simple random sampling method.

- The outcome measures included pain intensity, which was assessed using the Numerical Pain Rating Scale (NPRS), functional ability, evaluated using shoulder pain and disability index (SPADI).

**Statistical analysis:**

- Data analysis was done using SPSS version 25.0.
- Descriptive analysis was done in a form of mean ± SD.
- Chi-square tests were employed for categorical variables to assess differences between groups.
- For within-group comparisons, paired t-tests were applied based on data normality.
- Between-group differences were analyzed using unpaired t-test.
- A significance level of $p < 0.05$ was considered statistically significant throughout the analysis.

**RESULTS AND DISCUSSION**

There was no significant difference in age or gender distribution between Group A and Group B ($p > 0.05$), indicating both groups were demographically comparable at baseline **(Table 1)**.

Group A and B have similar age averages (21.75 vs. 21.2). Both groups have more females than males, with nearly equal gender distributions **(Figure 1)**.

The statistical analysis shows that both Group A and Group B had significant improvements within their groups for NPRS and SPADI scores ($p = 0.001$). However, the between-group comparison shows no significant difference in outcomes, as all p-values are greater than 0.05. This indicates that both interventions were equally effective in reducing pain and improving function **(Chart 1)**.

The bar charts illustrate the post-intervention scores for NPRS and SPADI in Group A and Group B. Both groups show similar outcomes, with Group A having a slightly higher NPRS score (3.4 vs. 3.3) and a slightly lower SPADI score (97.3 vs. 97.55) compared to Group B. These minimal differences suggest that both interventions had comparable effectiveness in reducing pain and improving shoulder function **(Chart 2)**.

**Table 1: Demographic Data**

| | Group A | Group B | p value |
|---|---|---|---|
| Age | 21.75±1.97 | 21.2±1.73 | 0.7854 |
| Gender (male) | 6 | 7 | 0.452 |
| Gender (female) | 14 | 13 | |

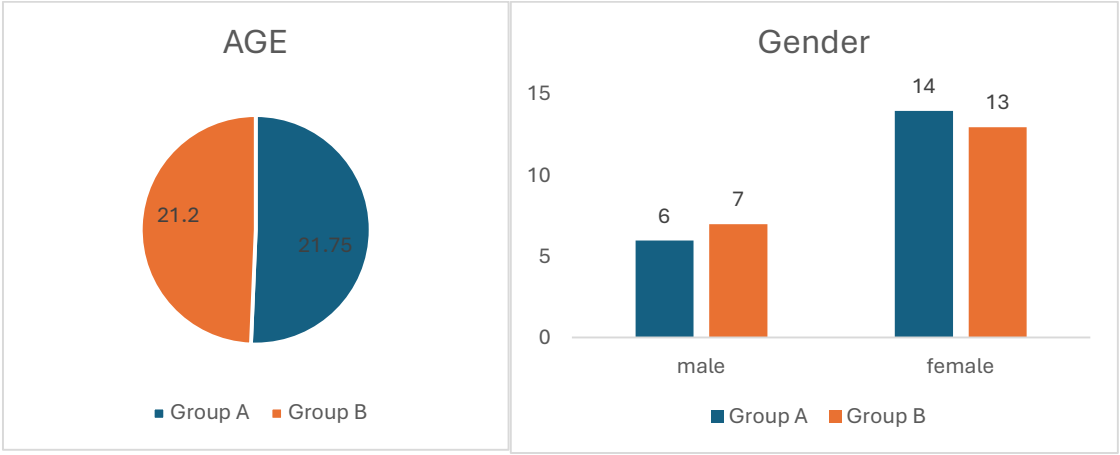


**Chart 1: Demographic Data**

**Table 2: statistical analysis of both the group and between the group**

| Outcome measure | | Group A | | Group B | | Between group |
|---|---|---|---|---|---|---|
| | | Mean | SD | Mean | SD | p value |
| NPRS | Pre | 6.5 | 1.35 | 6.4 | 1.50 | 0.8745 |
| | Post | 3.4 | 0.88 | 3.3 | 1.03 | 0.1254 |
| p value (within group) | | 0.001 | | 0.001 | | |
| SPADI | Pre | 117.45 | 5.95 | 116.8 | 7.77 | 0.5468 |
| | Post | 97.3 | 7.76 | 97.55 | 7.19 | 0.2534 |
| p value (within group) | | 0.001 | | 0.001 | | |

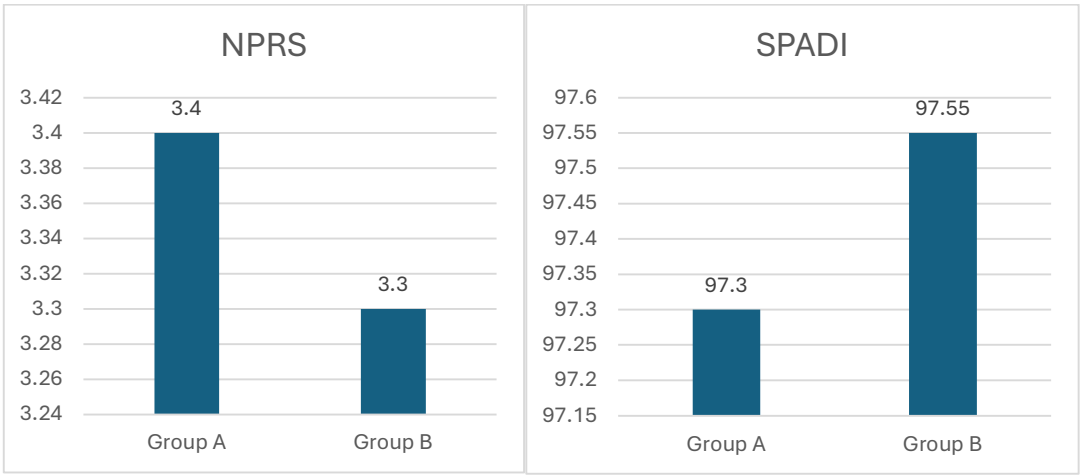


**Chart 2: Comparative Analysis of NPRS and SPADI Scores Between Groups**

## DISCUSSION:

This study revealed that both core strengthening and scapular stabilization exercises significantly reduced shoulder pain and improved function in college students with Rounded Shoulder Posture (RSP). The lack of significant difference between the two groups aligns with existing literature suggesting that both strategies are effective in addressing postural and musculoskeletal dysfunctions associated with RSP.

Scapular stabilization exercises have been extensively studied for their role in correcting scapular dyskinesis and reducing shoulder-related pain. **Cools *et al.* (2014)**

**[15**] emphasized that targeted scapular rehabilitation, particularly strengthening the middle/lower trapezius and serratus anterior, restores scapular control and relieves pain in overhead athletes and individuals with posture-related dysfunctions. Similarly, **De Mey *et al*. (2012) [16]** demonstrated that scapular-focused training led to significant improvements in shoulder proprioception and muscular balance. In a clinical trial, **Kim *et al*. (2018) [17]** found that posterior scapular tilt exercises were more effective than stretching in improving posture and scapular kinematics among individuals with RSP.

Several recent studies support the effectiveness of scapular stabilization in sedentary young adults. **Kang *et al*. (2018) [18]** showed that elastic band exercises targeting the scapula significantly reduced symptoms in university students with upper crossed syndrome. Additionally, **Yoon and Lee (2018) [19]** observed that scapular exercises not only improved posture but also enhanced electromyographic activity in the scapular muscles, supporting their neuromuscular benefits. **Zhong *et al*. (2024) [20]** in a systematic review highlighted consistent improvements in shoulder pain and function following scapular muscle retraining across diverse populations.

Core strengthening also plays a crucial role in upper extremity function by providing a stable base for scapular and glenohumeral motion. **Akuthota and Nadler (2004) [21] and Kibler *et al*. (2006) [22]** proposed that proximal trunk stability is essential for efficient shoulder mechanics and force transfer, especially during functional and athletic tasks. **Abd El-Azeim *et al*. (2022) [23]** found that adding core exercises to scapular rehabilitation significantly enhanced posture correction and shoulder strength in patients with RSP. Similarly, **Shiravi *et al*. (2019) [24**] reported greater improvements in alignment, pain reduction, and shoulder endurance in a group performing combined core and scapular exercises versus scapular training alone.

Comparative studies have also shown the value of integrating core stability into shoulder rehabilitation. **Wilson *et al*. (2015) [25]** demonstrated that combining shoulder and core training improved functional movement patterns and reduced pain in individuals with poor postural habits. A meta-analysis by **Kim *et al*. (2023) [26]** confirmed that strengthening exercises targeting the trunk and scapula together provided better overall outcomes for posture and function than isolated interventions.

Also, our study mirrors the findings of **Eraslan *et al*. (2024) [27],** who concluded that both core and scapular exercises independently improved postural alignment and shoulder mechanics, but neither proved significantly superior. This suggests that both interventions address distinct yet

interconnected components of shoulder function—core exercises optimize proximal control while scapular stabilization corrects local muscle imbalances.

**CONCLUSION:**

This study found that both core strengthening and shoulder stabilization exercises significantly reduced pain and improved shoulder function in individuals with Rounded Shoulder Posture (RSP). The lack of a statistically significant difference between the two groups indicates that both interventions are comparably effective in addressing postural imbalances and associated dysfunctions. These results support the inclusion of either core-focused or scapular-focused exercise programs in rehabilitation strategies for RSP.

Future studies should examine the long-term effects of these interventions with larger populations and extended follow-up periods. Exploring the potential benefits of combined core and scapular training may reveal additive or synergistic effects. Incorporating biomechanical tools such as electromyography (EMG) or motion analysis could provide further insight into the neuromuscular mechanisms underlying these improvements.

**ACKNOWLEDGEMENT:**

The authors would like to express their sincere gratitude to the participants who volunteered for this study. Special thanks to the faculty and staff of the Department of Physiotherapy for their continuous support and guidance throughout the research process.

**REFERENCES:**

**[1]** Kebaetse M, McClure P, Pratt NA. Thoracic position effect on shoulder range of motion, strength, and three-dimensional scapular kinematics. Arch Phys Med Rehabil. 1999;80(8):945–950.

**[2]** Borstad JD, Ludewig PM. The effect of pectoralis minor resting length on scapular kinematics in healthy individuals. J Orthop Sports Phys Ther. 2005;35(4):227–238.

**[3]** Sharma S, Singh R, Kumar A. Prevalence of rounded shoulder posture among college students and its association with daily posture-related habits: A cross-sectional study. J Bodyw Mov Ther. 2022; 29: 159–165.

**[4]** Kim JH, Lee SW. Prevalence and associated factors of rounded shoulder posture and neck pain among university students. Phys Ther Rehabil. 2023; 9(2): 112–118.

**[5]** Ludewig PM, Cook TM. Alterations in shoulder kinematics and muscle activity in people with symptoms of shoulder impingement. Phys Ther. 2000; 80(3): 276–291.

**[6]** Kibler WB, Press J, Sciascia A. The role of core stability in athletic

function. Sports Med. 2006;36(3):189–198.

**[7]** Cools AM, *et al*. Rehabilitation of scapular muscle balance: which exercises to prescribe? Am J Sports Med. 2007;35(10):1744–1751.

**[8]** Silfies SP, Ebaugh DD, Pontillo M, Butowicz CM. Critical review of the impact of core stability on upper extremity athletic injury and performance. Br J Sports Med. 2015;49(6):349–354.

**[9]** Akuthota V, Ferreiro A, Moore T, Fredericson M. Core stability exercise principles. Curr Sports Med Rep. 2008;7(1):39–44.

**[10]** De Mey K, Cagnie B, Danneels L, Cools AM. Scapular muscle rehabilitation exercises in overhead athletes with impingement symptoms: effect of a 6-week training program on muscle recruitment and functional outcome. Br J Sports Med. 2012;46(2):110–115.

**[11]** Salaffi F, Di Carlo M, Farah S, *et al*. Measurement properties of the numerical rating scale for pain in patients with musculoskeletal disorders: A systematic review. J Clin Med. 2021;10(17):3937.

**[12]** Williamson A, Hoggart B. Pain: A review of three commonly used pain rating scales. J Clin Nurs. 2005;14(7):798–804.

**[13]** Chen S, Zhang Q, Li X, *et al*. Psychometric properties of the Shoulder Pain and Disability Index (SPADI) in patients with shoulder disorders: A meta-analysis. Clin Rehabil. 2022;36(1):57–69.

**[14]** MacDermid JC, *et al*. Measurement properties of the SPADI: A systematic review. J Orthop Sports Phys Ther. 2011;41(2):90–103.

**[15]** Cools AM, Struyf F, De Mey K, Maenhout A, Castelein B, Cagnie B. Rehabilitation of scapular dyskinesis: From the office worker to the elite overhead athlete. Br J Sports Med. 2014;48(8):692–697.

**[16]** De Mey K, Cagnie B, Cools AM, Danneels L. Trunk muscle activity during bridging exercises on a stable and unstable surface in professional and amateur athletes. Int J Sports Phys Ther. 2012;7(6):627–636.

**[17]** Kim MK, Shin YJ, Seo JH. The effect of posterior tilt exercise on rounded shoulder posture. J Phys Ther Sci. 2018;30(3):401–404.

**[18]** Kang JI, Kim MY, Kim YH. Effects of scapular stabilization exercise using elastic band on postural alignment and shoulder pain in

university students with upper crossed syndrome. J Phys Ther Sci. 2018;30(9):1166–1170.

**[19]** Yoon JO, Lee JH. Effects of scapular stabilization exercise on muscle activity and posture in subjects with forward head posture. J Exerc Rehabil. 2018;14(3):460–465.

**[20]** Zhong Z, Wang X, Tan J. Effectiveness of scapular stabilization exercise on shoulder pain and function: A systematic review and meta-analysis. Arch Phys Med Rehabil. 2024;105(2):254–262.

**[21]** Akuthota V, Nadler SF. Core strengthening. Arch Phys Med Rehabil. 2004;85(3 Suppl 1):S86–S92.

**[22]** Kibler WB, Press J, Sciascia A. The role of core stability in athletic function. Sports Med. 2006;36(3):189–198.

**[23]** Abd El Azeim AS, El Esaily SS, Farid TM. Effect of adding core stability exercises to scapular stabilization training on postural alignment in patients with rounded shoulder posture. J Back Musculoskelet Rehabil. 2022;35(1):149–157.

**[24]** Shiravi S, Shamsi MB, Sobhani S. Effect of abdominal draw-in maneuver on scapular position, pain, and endurance in subjects with forward shoulder posture: A randomized controlled trial. J Bodyw Mov Ther. 2019;23(4):848–854.

**[25]** Wilson JD, Dougherty CP, Ireland ML, Davis IM. Core stability and its relationship to lower extremity function and injury. J Am Acad Orthop Surg. 2015;13(5):316–325.

**[26]** Kim SY, Lee JH, Lee BH. Effectiveness of core and scapular stabilization training in patients with upper crossed syndrome: A systematic review and meta-analysis. BMC Musculoskelet Disord. 2023;24:95.

**[27]** Eraslan L, Ulusoy M, Karayigit R. Comparison of scapular stabilization and core strengthening in the treatment of upper crossed syndrome: A randomized controlled trial. Physiother Theory Pract. 2024;40(2):165–172.