



(REVIEW ARTICLE)



## EFFECTIVENESS OF SHOULDER GIRDLE DYNAMIC NEUROMUSCULAR STABILIZATION EXERCISES ON HAND MUSCLE STRENGTH AMONG NORMAL YOUNG INDIVIDUALS

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### ABSTRACT

The shoulder girdle provides proximal stability essential for efficient upper-extremity movement and hand muscle force generation. Dynamic Neuromuscular Stabilization (DNS) and shoulder girdle stabilization exercises aim to improve proximal stability, neuromuscular coordination, and force transmission through the upper-extremity kinetic chain. This narrative review aimed to examine the effectiveness of shoulder girdle neuromuscular stabilization exercises on hand muscle strength among healthy young individuals. A literature search was conducted using PubMed, Google Scholar, ResearchGate, ScienceDirect, and other accessible academic sources for studies published between 2015 and 2025. Seven relevant studies were reviewed. The findings demonstrated improvements in handgrip strength, proximal shoulder stability, neuromuscular coordination, and upper-extremity function following stabilization-based exercises. The evidence suggests that improved proximal stability may enhance hand muscle performance. Further high-quality studies with larger samples are recommended.

**Keywords:** Dynamic Neuromuscular Stabilization, Shoulder Girdle Stabilization, Scapular Stabilization, Hand Grip Strength, Hand Muscle Strength, Young adults.

### 1 INTRODUCTION

The shoulder girdle is an essential component of the upper extremity that provides both mobility and stability for functional movements. It consists of the scapula, clavicle, humerus, and surrounding muscles, which work together to facilitate activities such as reaching, lifting, throwing, pushing, pulling, and gripping. Efficient upper-limb function depends on adequate proximal stability, allowing effective force transmission from the trunk to the hand. Impairment of shoulder stability may reduce hand muscle strength, alter movement patterns, and negatively affect overall upper-extremity performance.

Dynamic Neuromuscular Stabilization (DNS) is a rehabilitation approach based on the principles of developmental kinesiology. It aims to restore optimal movement patterns by improving core stability, postural alignment, diaphragmatic breathing, and neuromuscular coordination. Unlike conventional strengthening exercises that primarily focus on isolated muscles, DNS promotes activation of the integrated spinal stabilization system and coordinated movement throughout the kinetic chain. This facilitates efficient force generation and movement quality during functional activities.

The scapula plays a vital role in maintaining normal shoulder biomechanics by providing a stable base for glenohumeral movement. The coordinated activity of the serratus anterior, trapezius, rhomboids, rotator cuff, and other scapular stabilizers is essential for maintaining dynamic shoulder stability. Scapular stabilization exercises enhance muscle activation, improve postural control, reduce abnormal movement patterns, and optimize upper-extremity function.

The principle of proximal stability for distal mobility suggests that improved shoulder girdle stability enhances force transmission throughout the upper-extremity kinetic chain, thereby improving hand muscle performance. Hand grip strength is widely used as a reliable indicator of upper-extremity muscle function and functional capacity. Although grip strength is generated by the forearm and hand muscles, its performance is influenced by proximal shoulder stability, neuromuscular coordination, and efficient activation of the scapular stabilizers. Therefore, interventions targeting shoulder stability may significantly improve distal hand muscle strength.

Several studies have demonstrated positive effects of shoulder stabilization programmes on hand grip strength. Kobesova et al. reported significant improvements in handgrip and pinch strength after six weeks of shoulder girdle dynamic stabilization exercises in healthy females, supporting the role of proximal stabilization in enhancing distal muscle performance. Similarly, Gaikwad et al. observed an approximately 27% increase in hand grip strength following four weeks of Shoulder Girdle Neuro Dynamic Stabilization exercises among healthy young adults.

Kachanathu et al. demonstrated significant improvements in hand grip strength, shoulder stability, and functional performance following shoulder stabilization exercises in patients with shoulder impingement syndrome. Bhide et al. also found that dynamic scapular muscle exercises significantly improved grip strength in healthy young adults by enhancing scapular muscle activation and force transmission.

Yong reported progressive improvements in grip strength, shoulder stability, pain reduction, and upper-extremity function after a three-month adapted Dynamic Neuromuscular Stabilization programme in an individual with bilateral epicondylitis. Furthermore, Wallace et al., in their systematic review, concluded that Dynamic Neuromuscular Stabilization is an effective rehabilitation approach for improving proximal stability, postural control, and upper-extremity function compared with conventional physiotherapy interventions. Squires also demonstrated improvements in shoulder biomechanics, neuromuscular control, muscle strength, and functional performance following dynamic shoulder stabilization exercises in patients with shoulder girdle pain.

Although the available evidence consistently supports the beneficial effects of Dynamic Neuromuscular Stabilization and shoulder stabilization exercises, the literature includes diverse study populations, intervention protocols, and outcome measures. Therefore, a comprehensive review is required to summarize the available evidence regarding their effectiveness on hand muscle strength and upper-extremity function. The findings of this literature review may assist physiotherapists in incorporating evidence-based shoulder girdle stabilization exercises into rehabilitation programmes aimed at improving grip strength and functional upper-limb performance.

The shoulder girdle provides essential proximal stability for efficient upper-extremity movement and force generation. Previous studies have reported improvements in handgrip strength following Dynamic Neuromuscular Stabilization, shoulder stabilization, and dynamic scapular muscle exercises. However, the available evidence is limited by variations in study populations, intervention protocols, and study designs. In addition, limited literature has specifically summarized the effect of shoulder girdle neuromuscular stabilization exercises on hand muscle strength among healthy young individuals. Therefore, a narrative review is needed to synthesize the available evidence, assess the effectiveness of these interventions on hand muscle strength, and identify gaps for future research.

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## 2 REVIEW OF LITERATURE

A total of seven relevant articles were reviewed to examine the effects of proximal shoulder girdle and scapular stabilization exercises on handgrip strength and upper-limb function. The reviewed studies included experimental studies, a systematic review, and case-based studies conducted in healthy individuals as well as clinical populations.

Previous studies have demonstrated that proximal shoulder girdle and scapular stabilization exercises can positively influence distal hand muscle strength and upper-limb function. Kobesova et al. (2015) conducted a controlled experimental study on 20 healthy female volunteers and reported significant improvements in handgrip strength in neutral, pronated, and supinated positions, as well as tripod pinch strength, following six weeks of Dynamic Neuromuscular Stabilization (DNS)-based shoulder girdle stabilization exercises. The greatest improvement was observed in neutral handgrip strength, supporting the role of proximal stabilization in enhancing distal muscle performance. Similarly, Gaikwad et al. (2025) found a significant improvement in handgrip strength following four weeks of DNS-based shoulder girdle stabilization exercises in healthy young individuals, further supporting the effectiveness of DNS in improving hand muscle strength. Orozco et al. (2022), through a systematic review, reported

that DNS interventions improve proximal stability, neuromuscular coordination, movement quality, balance, and upper-limb functional performance when compared with conventional physiotherapy interventions. These findings suggest that enhanced proximal stability may facilitate more efficient force transmission throughout the kinetic chain and consequently improve distal upper-limb performance.

The effect of shoulder stabilization on handgrip strength has also been demonstrated in clinical populations. Kachanathu et al. (2019) reported significant improvements in handgrip strength, shoulder stability, and functional performance following a supervised shoulder stabilization programme in individuals with unilateral shoulder impingement syndrome. Interestingly, improvements in grip strength were observed in both the affected and unaffected upper limbs, indicating the possible influence of neuromuscular coordination and bilateral kinetic-chain adaptations. Yong (2019), in a clinical case study involving a patient with bilateral medial and lateral epicondylitis, reported progressive improvements in grip strength, pain, shoulder stability, and upper-limb function following an adapted DNS programme. The findings suggested that proximal stabilization may enhance force transmission to the distal segments without direct hand muscle strengthening. Similarly, Bhide et al. (2018) demonstrated a highly significant improvement in handgrip strength following four weeks of dynamic scapular strengthening exercises in healthy young adults, highlighting the contribution of scapular stabilizers to distal hand performance. Squires (2017), in a case series involving patients with shoulder girdle pain, also reported improvements in pain, shoulder range of motion, muscle strength, and upper-limb function following a dynamic shoulder stabilization programme. Collectively, these studies indicate that exercises targeting the shoulder girdle and scapular stabilizers may improve handgrip strength through enhanced proximal stability, neuromuscular coordination, and kinetic-chain force transmission.

However, the available literature includes relatively small samples, case studies, and heterogeneous intervention protocols, indicating a need for further research to establish the specific effects of structured proximal stabilization exercises on handgrip strength in healthy individuals.

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### 3 METHODOLOGY

A literature review was conducted using PubMed, Google Scholar, ResearchGate, and ScienceDirect. The search was performed for studies published between 2015 and 2025 using the keywords “Dynamic Neuromuscular Stabilization,” “Shoulder Girdle Stabilization,” “Grip Strength,” “Hand Muscle Strength,” “Scapular Stabilization,” and “Young Adults.” Studies were included if they investigated shoulder girdle stabilization exercises or Dynamic Neuromuscular Stabilization (DNS), included male or female participants aged 18–40 years, evaluated hand muscle strength as an outcome measure, were published in English, and were available as full-text articles. Experimental studies, randomized controlled trials, clinical trials, systematic reviews, case studies, and narrative reviews were considered. Studies involving neurological disorders, upper-limb fractures, major trauma, post-surgical conditions, systemic diseases affecting muscle strength, infective or inflammatory musculoskeletal conditions, and duplicate or incomplete publications were excluded.

## 4 PROCEDURE

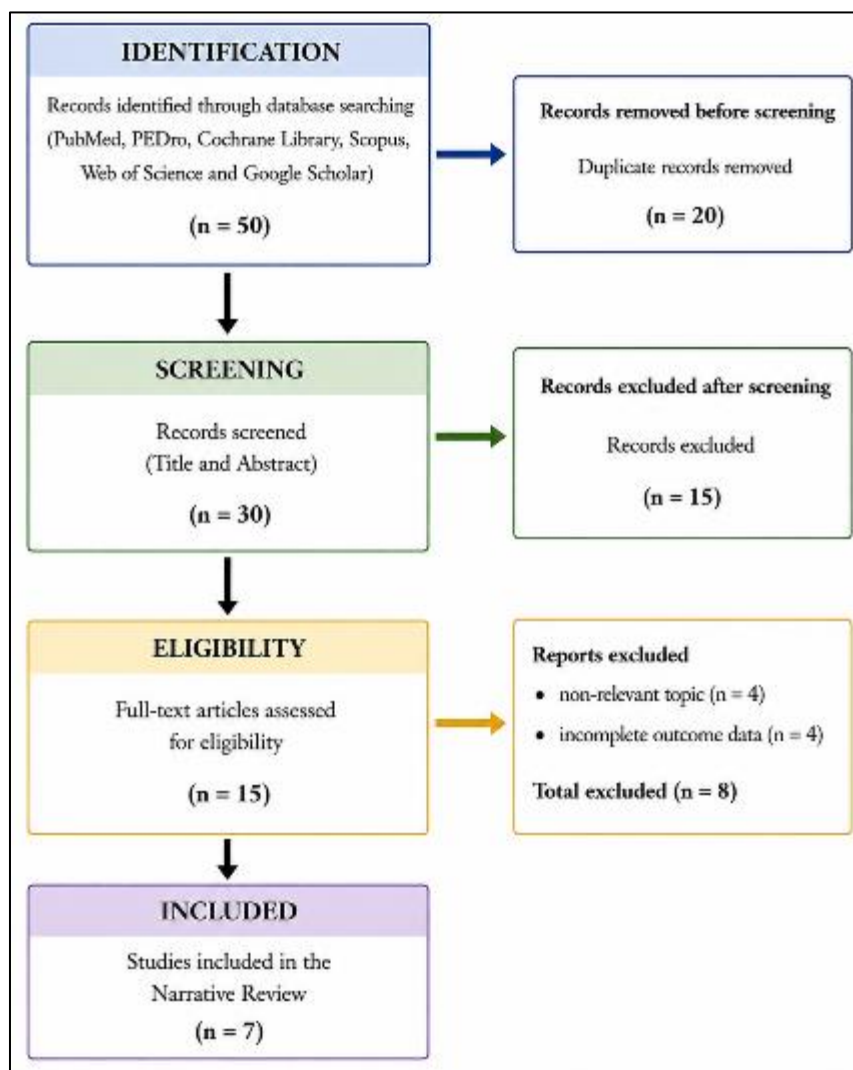


Figure 1: Prisma FlowChart

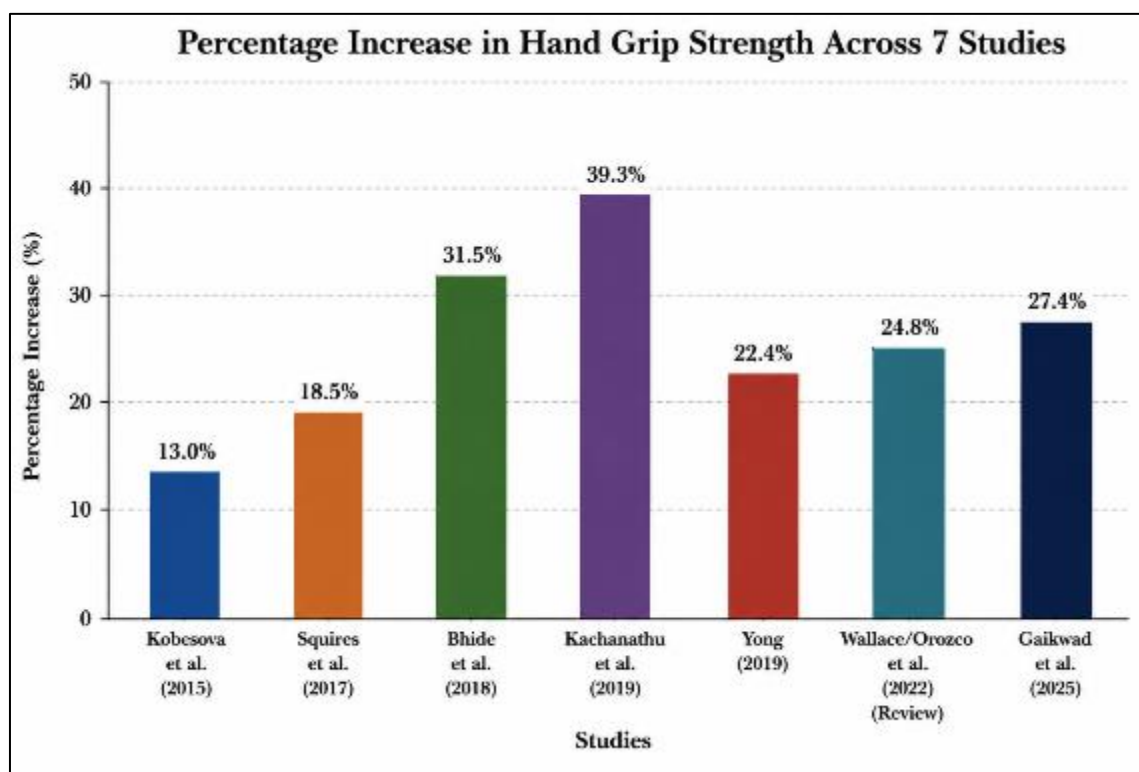
## 5 RESULTS

A total of seven studies were included in this literature review to evaluate the effectiveness of Dynamic Neuromuscular Stabilization (DNS), shoulder girdle stabilization exercises, shoulder stabilization exercises, and dynamic scapular muscle exercises on hand muscle strength and upper-extremity function. The included studies comprised one controlled experimental study, one quasi-experimental study, one systematic review, one experimental clinical study, one clinical case study, one experimental study, and one case series.

The study by Kobesova et al. demonstrated significant improvements in handgrip and tripod pinch strength following six weeks of shoulder girdle dynamic stabilization exercises in healthy females, indicating that improved proximal shoulder stability enhances distal hand muscle performance. Similarly, Gaikwad et al. reported an approximately 27% improvement in hand grip strength after four weeks of Shoulder Girdle Neuro Dynamic Stabilization exercises in healthy young adults.

The remaining studies consistently demonstrated that Dynamic Neuromuscular Stabilization, shoulder stabilization exercises, and dynamic scapular muscle exercises improve proximal stability, neuromuscular coordination, shoulder function, postural control, and upper-extremity performance. Studies by Kachanathu et al., Yong, and Bhide et al. also reported significant improvements in hand grip strength following stabilization-based exercise programmes.

Overall, the available evidence suggests that Dynamic Neuromuscular Stabilization and shoulder girdle stabilization exercises are effective in improving hand muscle strength, grip strength, shoulder stability, and upper-extremity function.



**Figure 2: Percentage increase in handgrip strength reported across seven studies.**

## 6 DISCUSSION

The present literature review evaluated the effectiveness of Dynamic Neuromuscular Stabilization (DNS), shoulder girdle stabilization exercises, shoulder stabilization exercises, and dynamic scapular muscle exercises on hand muscle strength and upper-extremity function. The reviewed studies consistently demonstrated that improving proximal shoulder stability enhances neuromuscular coordination, force transmission, shoulder function, and hand grip strength.

The study by Kobesova et al. provides early evidence supporting the effectiveness of shoulder girdle dynamic stabilization exercises in healthy adults. Participants who completed the six-week exercise programme demonstrated significant improvements in handgrip and pinch strength, suggesting that improved shoulder stability facilitates efficient force transmission through the upper-extremity kinetic chain. Likewise, Gaikwad et al. reported an approximately 27% increase in hand grip strength following four weeks of Shoulder Girdle Neuro Dynamic Stabilization exercises in healthy young adults.

Similarly, Wallace et al. concluded that Dynamic Neuromuscular Stabilization improves proximal stability, postural control, and upper-extremity function when compared with conventional physiotherapy interventions. Kachanathu et al., Yong, and Bhide et al. also observed improvements in hand grip strength following stabilization-based exercise programmes, while Squires demonstrated improved shoulder biomechanics, neuromuscular control, muscle strength, and functional performance after dynamic shoulder stabilization exercises.

Although the findings are encouraging, differences in study design, sample size, intervention duration, participant characteristics, and outcome measures limit direct comparison among the studies. Most studies included relatively small sample sizes or specific clinical populations, which may affect the generalizability of the findings.

Overall, the reviewed literature supports the use of Dynamic Neuromuscular Stabilization and shoulder girdle stabilization exercises as effective physiotherapy interventions for improving shoulder stability, hand muscle strength, and upper-extremity function. Further randomized controlled trials with larger sample sizes and standardized rehabilitation protocols are recommended to strengthen the current evidence.

## 7 CONCLUSION

Based on the available evidence, Dynamic Neuromuscular Stabilization (DNS), shoulder girdle stabilization exercises, shoulder stabilization exercises, and dynamic scapular muscle exercises are effective in improving hand muscle strength by enhancing proximal shoulder stability, neuromuscular coordination, and upper-extremity function.

The reviewed studies consistently demonstrated positive effects on hand grip strength, shoulder stability, and functional performance. Kobesova et al. and Gaikwad et al. reported significant improvements in hand muscle strength among healthy individuals following Dynamic Neuromuscular Stabilization-based shoulder girdle exercise programmes, while the remaining studies demonstrated similar benefits in both healthy individuals and patients with shoulder dysfunction.

The findings support the principle of proximal stability for distal mobility, indicating that improved shoulder girdle stability facilitates efficient force transmission throughout the upper-extremity kinetic chain, thereby enhancing hand muscle performance.

Overall, current evidence supports the incorporation of Dynamic Neuromuscular Stabilization and shoulder girdle stabilization exercises into physiotherapy rehabilitation programmes aimed at improving hand grip strength, shoulder stability, and upper-extremity function. However, further high-quality randomized controlled trials with larger sample sizes are recommended to strengthen the existing evidence and establish standardized rehabilitation protocols.

## STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

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### *Disclosure of conflict of interest*

The authors declare that there is no conflict of interest.

### *Author contributions*

- **Pallavi P:** Conceptualization, literature search, study selection, data extraction, writing—original draft, and final approval.
- **Preethu Mohanan K. K.:** Methodology, supervision, critical review, manuscript revision, and final approval.
- **Belle Sharvani:** Literature search, study selection, data extraction, writing—review and editing, and final approval.
- **Manjunatha H:** Supervision, administrative support, manuscript review, and final approval.

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