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Passive Stretching Intervention for Upper Back Muscle Imbalance: A Focus on the Rhomboid Muscle in Adults

Sandhya Kresnajati[1]✉, Riki Edo Saputro[2], Aziz Amrulloh[3], M Syahrul Muafi[4], Dicky Budhi Setiawan[5]

Sports Science, Universitas Negeri Semarang, Indonesia[134]
Physical Education, Universitas Wahid Hasyim Semarang, Indonesia[2]
Elementary School Physical Education, Universitas Negeri Semarang, Indonesia[5]

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Abstract

Adults are increasingly experiencing upper back muscle imbalances, particularly rhomboid muscle tightness, often due to prolonged sitting and poor posture. This study aimed to evaluate the effectiveness of a single passive stretching session in relieving rhomboid muscle tightness in adults. A one-group pretest-posttest quasi-experimental design was employed using pre-existing data from Klinik Satu Sehat Semarang, which included 13 adults aged 18 to 59 years. Each participant underwent a single passive stretching session, and measurements of shoulder movement and muscle tightness were taken before and after using a goniometer and the Visual Analog Scale (VAS). A paired t-test revealed a statistically significant reduction in muscle tightness ($p = 0.004$), with an average decrease of two VAS points. Additionally, shoulder retraction range of motion increased by an average of 6 degrees ($p = 0.001$). Passive stretching of the rhomboid muscle effectively improves shoulder mobility and reduces upper back stiffness in adults within a single session, making it a practical method for addressing muscle problems caused by poor posture and applicable in rehabilitation and prevention programs.

How to Cite

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✉ Correspondence Author:
E-mail: sandhyakresna@mail.unnes.ac.id

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INTRODUCTION

The upper back muscles play a crucial role in maintaining body posture and spinal stability during daily activities. This muscle complex consists of various muscle groups, including the trapezius, rhomboid, levator scapulae, and serratus anterior muscles, which work synergistically to control the position and movement of the scapula and maintain the alignment of the cervicothoracic spine (ISHII et al., 2018; Kulow et al., 2022). In today›s era, with the increasing prevalence of sedentary lifestyles and intensive technology use, imbalances in the upper back muscles have become a common health issue, particularly among the productive adult population who spend prolonged periods in seated positions with forward head posture and rounded shoulder posture.

The rhomboid muscles, consisting of the rhomboid major and rhomboid minor, are an important component of the scapulothoracic stability system (Badura et al., 2016; Metin Ökmen et al., 2018). The rhomboid major muscle originates from the spinous processes of vertebrae T2-T5 and inserts into the medial border of the scapula, while the rhomboid minor muscle originates from the spinous processes of C7-T1 and inserts into the superior portion of the medial border of the scapula (Beger et al., 2018). Biomechanically, the rhomboid muscles function to perform scapular retraction, scapular elevation, and downward scapular rotation, and act as scapular stabilizers during upper extremity movements (Beger et al., 2018). Dysfunction or imbalance in the rhomboid muscles can lead to altered scapular kinematics, contributing to the development of upper crossed syndrome, characterized by forward head posture, increased thoracic kyphosis, and protracted shoulders (Chang et al., 2023; Pires et al., 2024).

Passive stretching is a therapeutic modality that has been proven effective in improving muscle flexibility and reducing muscle tension (Laroche & Connolly, 2006). This method uses external force to stretch muscles without active movement by the individual, allowing the muscles to fully relax during the stretch (Nishikawa et al., 2015). Physiologically, passive stretching works through viscoelastic deformation of the muscle-tendon unit, which results in stress relaxation in the connective tissue. The optimal duration is 15 and 30 seconds per repetition to achieve significant changes in muscle length and tension (Phil et al., 2012).

The theory of mechanical tension regulation explains that excessive muscle tension can be reduced through the application of controlled passive stretching, which induces changes in the length-tension relationship at the sarcomere level (Herzog, 2018). Stretching stimuli activate mechanoreceptors in muscle fascia and tendons, which can modulate pain perception and muscle guarding responses through the gate control theory mechanism (Proske & Gandevia, 2025). Additionally, passive stretching can enhance local blood circulation and metabolic waste removal from muscle tissue, contributing to muscle relaxation and the recovery process (Hotta et al., 2018). Evidence indicates that a single session of passive stretching can provide immediate effects on muscle tension reduction, although long-term adaptations require repeated exposure with consistent training stimuli.

A systematic review shows consistent evidence regarding the effectiveness of stretching interventions for upper extremity muscle tightness (Bryant et al., 2023; Shah et al., 2023; Takeuchi et al., 2024). Hidayatullah et al (2022) demonstrated that passive stretching improves shoulder flexibility and reduces discomfort in upper back tension. However, most existing studies focus on general upper body stretching with limited attention to the rhomboid muscle specifically. Existing research shows heterogeneity in methodology and outcome measures, and most involve athletic populations with little focus on adults with postural imbalances.

The effectiveness of a single passive stretching session in releasing tense rhomboid muscles in adults with upper back muscle imbalances is examined in this study by analyzing available clinical data. The primary objective of the study is to determine how quickly this treatment can improve shoulder movement and reduce muscle tightness by comparing measurements taken before and after the stretching. Using actual clinical data demonstrates how effective passive stretching is for common adults muscle problems in daily practice.

The study introduces a novel approach by developing a standardized passive stretching protocol for the rhomboid muscles in their proper anatomical position. Additionally, this study investigates the effectiveness of a single passive stretching session in reducing rhomboid muscle tension in adults with upper back muscle imbalances caused by poor posture. Unlike previous studies focused on athletes, this research uses a non-athlete adult population with posture issues resulting from a sedentary lifestyle. The findings of this study are expected to provide

deeper insights into the benefits of passive stretching for postural issues in the general population, which are often overlooked in the literature (Hidayatullah et al., 2022; Nitayarak & Charntaraviroj, 2021).

METHOD

This study examined pre-existing data from Klinik Satu Sehat Semarang using the basic before-and-after method with a single group of adult people. The objective was to observe the effects of a single passive stretching session on rhomboid muscle tightness. The study assessed the adults' feelings and the results of their tests before and after the stretching. It also examined all members of the same participant group by examining clinical records.

Data from 13 adults, ages 18 to 59 years who experienced tightness in their upper back muscles, particularly in the rhomboid area, were used in the study. Participants must have recorded sessions of receiving a single passive stretching treatment, have a clinical diagnosis of upper back muscle imbalance or rhomboid tightness, and be unrestricted of other muscle or nerve injuries to qualify and become eligible.

Each participant underwent a single passive stretching intervention targeting the rhomboid muscles. A trained physical therapist performed this intervention. During the procedure, participants were positioned in a sitting or prone position to facilitate access to the scapular area. The physical therapist performed passive scapular protraction to effectively stretch the rhomboid muscles. Each stretch was held for 30 seconds and repeated three times, with a 15-second rest between repetitions.

The **Figure 1** above shows that passive stretching interventions are performed by trained physical therapists, focusing on scapular protraction to reduce tension in the rhomboid muscles. Participants are placed in a sitting or prone position to ensure optimal access to the scapular region. The following is an explanation of each movement.

Starting Position (Seated): The participant sits on the therapy table with back support.

Stretching (Scapular Protraction): The therapist performs passive stretching without active movement from the participant.

Benefit: Allows full muscle relaxation, reduces stiffness, enhances flexibility, and improves shoulder mobility. Stretching Variations: Alternative techniques are used to achieve a deeper stretch in the upper back and shoulders.

This passive stretching intervention is designed to reduce muscle tension by relying on external force to stretch the muscles without involving active movement from the individual. Passive stretching is very effective for increasing muscle length and reducing tension because the muscles can fully relax during the stretching process. Stretching sessions are conducted for approximately 5 minutes per treatment (including stretching repetitions).

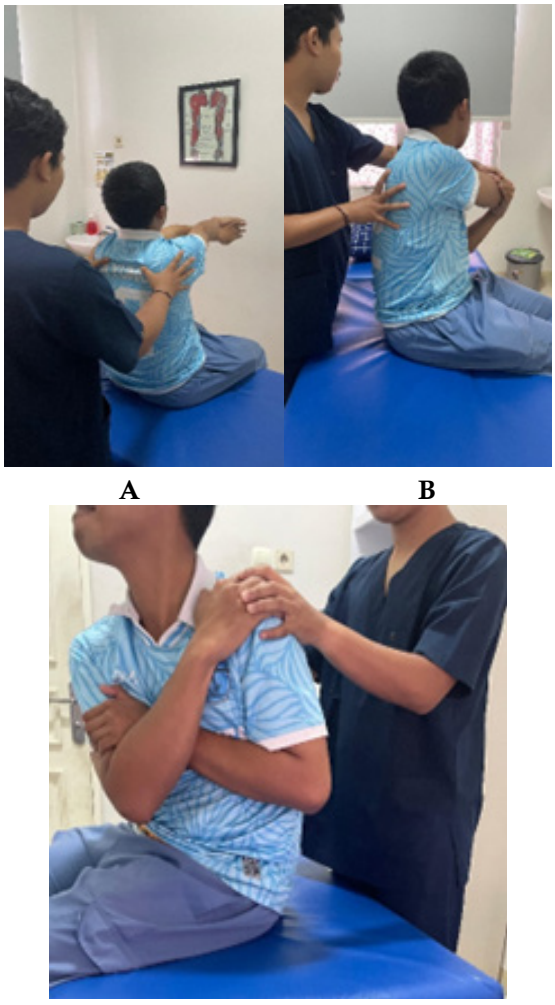

Figure 1. (**A**) Stretching movement Starting position (sitting), (**B**) Stretching movement Stretching (scapular protraction), (**C**) Variation of stretching movement

On a scale of 0 (no tightness) to 10 (very tight), participants were asked to rate their perception of muscle tightness using the Visual Analog Scale (VAS). Both measurements were taken right before and after to assess the passive stretching intervention's immediate effects.

The differences the VAS scores values before and after the intervention were evaluated

using paired sample t-tests. The standard deviation for statistical significance was set at $p < 0.05$. The SPSS version 25 was applied for all analyses.

RESULTS AND DISCUSSION

Table 1. Participant Characteristics

N = 13	Mean ± SD	Min	Max
Age (year)	29,85±8,01	19	44
Height (cm)	167±4,96	159	175
Weight (kg)	66,85±12,57	52	87
BMI (kg/m²)	24,69±4,33	20,3	32,2
Body fat (%)	19,08±7,91	7,6	30,6
Body mass (%)	30,75±4,58	25,8	37,9

Abbreviation: BMI, Body Mass Index; SBP, Systolic Blood Pressure; DBP, Diastolic Blood Pressure SD, Standard Deviation, Min, Minimum score; Max, Maximum Score.

According to the findings of a descriptive study of 13 respondents, the respondents' ages range from 19 to 44 years old, with an average age of 29.85 ± 8.01 years, suggesting a reasonably wide age range. With an average height of 167 ± 4.96 cm and a range of 159 to 175 cm, the respondents' heights are rather uniform. Respondents' weights range from 52 kg to 87 kg, with an average of roughly 66.85 ± 12.57 kg. This suggests a rather noticeable disparity in weight amongst people. The average Body Mass Index (BMI) is 24.69 ± 4.33 kg/m². In addition, the mean heart rate was 81.93 ± 10.76 bpm. The results also demonstrated Normal blood pressure, with an average SBP of 120,08 ± 22,55 mmHg and DBP of 73,46 ± 13,73 mmHg

Outcome Comparison

Table 2. Analysis of VAS Scores Before and After Intervention

Variable	Pre-Intervention	Post-Intervention
VAS Score (0–10)	5	2
	8	4
	7	3
	4	2
	8	5
	8	5
	6	4
	3	2
	0	0
	5	2
	7	3
	4	2
	4	2

Abbreviation: VAS, visual analogue scale.

The **Table 2** shows a decrease in VAS scores in almost all samples after receiving passive stretching treatment for rhomboid pain. Most samples experienced a significant reduction from pre-test to post-test.

Table 3. Paired Sample t-test Comparing VAS Scores Before and After Passive Stretching Treatment

	Mean ± SD	t	df	Sig
VAS Pre-test VAS Post-test	2,538±1,198	7,638	12	< 0.01*

Abbreviation: VAS, visual analogue scale
*p < 0.01 indicates statistical significance.

Passive stretching is a technique where muscles are stretched using an external force, such as a trained physiotherapist's hands or a stretching device, without active involvement from the individual. This method aims to reduce muscle tension, increase flexibility, and alleviate tightness, particularly for individuals experiencing poor posture or sedentary lifestyles (Sharman et al., 2006). The intervention in this study involved positioning participants either seated or prone to optimize access to the scapula region. The physiotherapist performed passive scapular protraction, effectively stretching the rhomboid muscles. Each stretch was held for 30 seconds, repeated three times, with 15-second rest intervals between repetitions. This technique proved to be effective in improving shoulder movement and relieving rhomboid muscle tightness, especially in individuals with upper back muscle imbalances.

The impact of passive stretching treatment on pain levels was assessed using a paired sample t-test. VAS assessments revealed a significant reduction in pain following passive stretching treatment ($p < 0.01$). Before the intervention, the average VAS pain score was 2.538 ± 1.198, according to the results of the paired sample t-test. After one passive stretching session, the analysis's findings revealed a statistically significant reduction in discomfort (t value = 7.638, df = 12, and $p < 0.01$). This decrease suggests that adult responders' rhomboid muscle tension can be effectively reduced by passive stretching treatment.

This study shows that adults with upper back muscle imbalances can significantly improve shoulder movement and relieve rhomboid muscle tightness with just one passive stretching session. The outcomes align with previous studies by D.Kay & J.Blazevich (2012), which discovered that passive stretching improves joint and muscle mobility by releasing stiff tendons

and muscle tissues. Similarly, static stretching, including passive techniques, can temporarily increase flexibility and decrease muscle tightness, particularly in those who have trouble moving freely or with tight muscles, as Behm et al (2015) demonstrated. Moreover, a clinical trial by D. G. Behm et al (2023) showed that passive stretching led to immediate improvements in shoulder flexibility and reduced discomfort in individuals with upper back strain. Compared to these studies, the present research adds specificity by focusing on the rhomboid muscles in adults, a population that has been underrepresented in musculoskeletal intervention literature. While earlier studies often examined stretching effects in athletes or general adult populations, this study demonstrates that even a single passive stretching intervention can yield measurable and beneficial outcomes in adult individuals experiencing postural imbalances, reinforcing its practical application in adult rehabilitation or educational health programs.

This study is distinctive because it clearly shows how passive stretching functions in practical settings, particularly for adults, using actual clinical data from routine outpatient treatment. The findings are more applicable and valuable because this research is based on real clinical practice rather than the regulated conditions of many laboratory studies. The rapid improvements in shoulder movement and muscle tightness are probably due to the muscles' increased elasticity, the nerves' relaxation, and the reduction in muscle tension following stretching effects that other studies have also confirmed (Sharman et al., 2006; Sp et al., 1996). For example, Sharman et al (2006) explained that passive stretching helps relaxing the nerves controlling the muscles, making it easier for the muscles to relax and stretch out. Similarly, D. G. Behm et al (2023) found that young adults experienced quick improvements in shoulder flexibility after doing static and passive stretching, which fits well with the results of this study.

Targeting adults with postural imbalances and using only one intervention session, the current study closes a gap in the literature compared to these studies, which mainly concentrated on athletic or elderly subjects. While previous literature often involved repeated sessions over several weeks (D. G. Behm et al., 2023; Nitayarak & Charntaraviroj, 2021), this study reveals that even a one-time application of passive stretching can yield significant short-term benefits in an adult population. These findings suggest that passive stretching may be a time-efficient and accessible therapeutic option in clinical or school-based health programs addressing adult postural dysfunctions

The results of this study may not be as broadly applicable to the larger adult population because of the small sample size. Furthermore, confirming that the improvements were exclusively generated by passive stretching without a control group is difficult because other factors could have been performed. Some crucial information, such as the participants' posture patterns, activity levels, or prior treatments, was absent because the study relied on pre-existing data, which might have affected the results. Despite these difficulties, the study offers helpful preliminary evidence that passive stretching can rapidly assist in reducing adults rhomboid muscle tightness. These results set the stage for further studies to better understand and validate these advantages using larger sample sizes, control comparisons, and more thorough data.

CONCLUSION

According to this study, adults' shoulder mobility is significantly improved, and upper back tightness can be significantly reduced with a single round of passive stretching focused on the rhomboid muscle. These findings indicate that passive stretching is an effortless, reliable, and rapid method of managing upper back muscle imbalances. This condition is increasingly prevalent in adult people due to excessive sitting and bad posture. Passive stretching may benefit rehab clinics, educational health initiatives, and programs to prevent muscle issues early because it is quick and straightforward.

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