14 (3) (2025) 798 - 803
Journal of Physical Education, Sport, Health and Recreations
https://journal.unnes.ac.id/journals/peshr

Postural Improvement Through Progressive Strengthening of Serratus Anterior and Rhomboid Muscle in Forward Head Posture Cases

Ika Guslanda Bustam[1]✉, Yudiansyah[2]

Physiotherapy, Faculty of Health, University of Muhammadiyah Ahmad Dahlan Palembang, Indonesia[12]

Article History

Received July 2025
Accepted October 2025
Published Vol.14 No.(3) 2025

Keywords:
Forward Head Posture; Serratus Anterior; Rhomboid; Neck Disability; Postural Corection; University Students

Abstract

Forward Head Posture (FHP) is a prevalent musculoskeletal disorder, especially among university students engaged in prolonged sedentary activities. Weakness in scapular stabilizing muscles such as the serratus anterior and rhomboids contributes significantly to postural misalignment and associated pain. This study aimed to investigate the effectiveness of progressive strengthening exercises targeting the serratus anterior and rhomboid muscles in improving craniovertebral angle, reducing neck pain, and enhancing functional outcomes in final-year university students with FHP. A quasi-experimental pre-test and post-test design was employed involving 67 final-year students. Participants were divided into an intervention group (n=33) and a control group (n=34). The intervention group underwent a progressive strengthening program 3 sessions per week over 4 weeks, while the control group received no physiotherapy. Outcome measures included craniovertebral angle (CVA), Numeric Rating Scale (NRS) for pain, and the Neck Disability Index (NDI). The intervention group demonstrated a significant improvement in CVA increased from 42.1° ± 2.5° to 49.3° ± 2.8° ($p < 0.001$), compared to a non-significant change in the control group 42.5° ± 2.3° to 43.1° ± 2.6° ($p < 0.001$). NRS decreased from 5.6 ± 1.2 to 2.1 ± 0.9 ($p = 0.000$), and NDI scores dropped from 32.4 ± 4.7 to 15.3 ± 3.9 ($p = 0.000$). The control group showed no significant changes in any measure. Progressive strengthening of the serratus anterior and rhomboid muscles is effective in correcting forward head posture, alleviating pain, and improving cervical function. These findings support the integration of targeted postural exercises into student wellness and physiotherapy programs.

How to Cite

Bustam, I. G., & Yudiansyah. (2025). Postural Improvement Through Progressive Strengthening of Serratus Anterior and Rhomboid Muscle in Forward Head Posture Cases. Journal of Physical Education, Sport, Health and Recreation, 14 (3), 798-803.

✉ Correspondence address :
E-mail: ikaguslanda@gmail.com

p-ISSN 2460-724X
e-ISSN 2252-6773

INTRODUCTION

Forward Head Posture (FHP) is one of the most common postural disorders in modern populations, particularly among university students who spend long hours studying, using laptops, or engaging in other sedentary activities (Arooj et al. 2022). FHP is characterized by the anterior translation of the head relative to the vertical midline, increasing mechanical load on the cervical spine and altering the balance of surrounding muscle (Abd-Elshafy et al. 2022; Poursadegh et al. 2023). This condition often leads to musculoskeletal discomfort, neck and shoulder pain, reduced functional mobility, and long-term musculoskeletal complications (Mostafaee et al. 2024).

Global prevalence data indicate that 66% to 85% of the general population may exhibit some degree of FHP, especially among individuals who maintain poor posture in groups with high sedentary behavior, such as students and office workers (Mostafaee et al. 2024). In Indonesia, a study by Swandari, at all (Swandari et al. 2023) revealed that approximately 70% of final-year university students exhibited symptoms of FHP, primarily associated with prolonged laptop use, poor sitting ergonomics, academic stress, and reduced physical activity. These numbers underscore the urgency of implementing effective interventions to address postural health, especially in student populations vulnerable to long-term sedentary behaviors (Stincel et al. 2023). This highlights a growing public health concern that warrants targeted preventive and rehabilitative strategies (Savitri PA n.d.).

Biomechanical standpoint, FHP leads to shortening of the upper trapezius and levator scapulae muscles, and simultaneous weakening of key scapular stabilizers, particularly the serratus anterior and rhomboids (Poursadegh et al. 2023). The serratus anterior is responsible for protracting and stabilizing the scapula, while the rhomboids contribute to scapular retraction and postural control. Weakness in these muscles is often linked to scapular winging and thoracic kyphosis, further exacerbating forward head alignment (Bustam 2024).

Intervention strategies for FHP often include a combination of deep cervical flexor training, postural correction education, and scapular muscle strengthening. Progressive strengthening exercises targeting the serratus anterior and rhomboids have been shown to enhance scapular positioning, improve cervical spine alignment, and reduce perceived pain and discomfort (Baek et al. 2025). These exercises typically involve controlled movements such as wall slides, scapular retractions, dynamic hugging, prone horizontal abduction, and resistance band training, which are safe and feasible for student populations (Güler et al. 2022).

Despite increasing awareness of FHP and its consequences, limited studies have explored the focused impact of progressive strengthening of the serratus anterior and rhomboid muscles on postural improvement among final-year university students. Therefore, this study aims to evaluate the effectiveness of such an intervention in improving postural alignment in students diagnosed with Forward Head Posture.

METHODS

This study employed a quasi-experimental design with pre-test and post-test comparisons between an intervention group and a control group. The total sample consisted of final-year university students who were currently in the process of completing their undergraduate thesis. Participants were selected based on inclusion criteria, which included a diagnosis of Forward Head Posture (FHP), the ability to follow the intervention protocol, and consent to participate voluntarily. Eligible participants who met the inclusion criteria were assigned into two groups: the intervention group and the control group. Each participant underwent a pre-test assessment to establish baseline data prior to the intervention.

Three main outcome measures were utilized in this study:

1. Forward Head Posture (FHP): Assessed using a biomechanical software program to determine craniovertebral angle and alignment deviation.
2. Pain Intensity: Measured using the Numeric Rating Scale (NRS), ranging from 0 (no pain) to 10 (worst pain imaginable).
3. Neck Disability: Evaluated using the Neck Disability Index (NDI) Questionnaire, which is a validated instrument for assessing the impact of neck pain on daily activities.

The intervention group received a structured program consisting of progressive strengthening exercises targeting the serratus anterior and rhomboid muscles over a predefined period. The exercise regimen included prone scapular Retraction (Rhomboid), Scapular wall Slide (Serratus Anterior dan Rhomboid), and wall Push-Up Plus (Serratus Anterior), performed under supervision. The control group did not receive any phy-

siotherapeutic intervention during the same period.

The exercise protocol provided to the control group in this study is as follows:

1.Prone Scapular Retraction

The respondent lies prone on the floor or a mat, with their arms positioned by their sides. They are then instructed to slowly raise both arms upward while drawing the shoulders back, ensuring that the scapulae converge. Afterward, the respondent is asked to lower the arms slowly back to the starting position with full control. This movement is intended to target the upper back muscles, particularly the rhomboid muscles, which play a crucial role in improving posture and enhancing shoulder stability (Seen **Figure 1**).

Figure 1. Prone Scapular Retraction (Rhomboid)

2.Scapular Wall Slide

Asked the respondent to stand with their back against the wall, elbows bent at a 90-degree angle, and arms resting against the wall. Slide your arms upward along the wall until they are fully extended, then return to the starting position while ensuring that your back remains in contact with the wall throughout the movement (Seen **Figure 2**).

3.Wall Push-Up Plus

Stand facing the wall with both hands placed on the wall at shoulder width. Perform a push-up movement against the wall, then finish by pressing into the wall, ensuring that the scapula moves away from the vertebrae (Seen **Figure 3**).

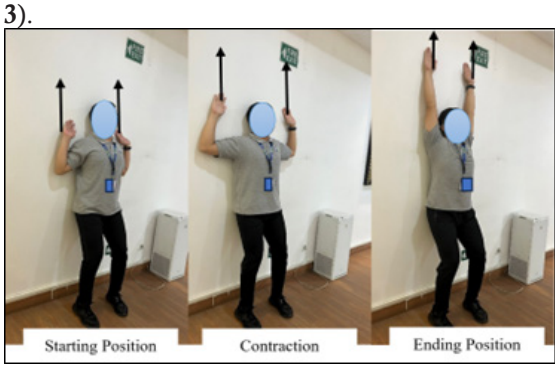


Figure 2. Scapular Wall Slide (Serratus Anterior dan Rhomboid)

Figure 3. Wall Push-Up Plus (Serratus Anterior)

All participants underwent a pre-test evaluation using the three outcome measures mentioned above. After the intervention phase (typically 4–6 weeks), a post-test assessment was conducted using the same tools and under the same conditions.

Participants were recruited from all final-year students of University Muhammadiyah Ahmad Dahlan Palembang. The inclusion and exclusion criteria were as follows:

Inclusion Criteria

1. Final-year university students currently completing their undergraduate thesis.
2. Diagnosed with Forward Head Posture (FHP) based on craniovertebral angle (CVA) measurement using biomechanical analysis software.
3. Aged between 20 and 25 years.
4. Willing and able to participate in the full duration of the study.
5. Provided written informed consent before participation

Exclusion Criteria

1. History of cervical spine injury, surgery, or congenital musculoskeletal disorders affecting posture.
2. Currently undergoing any form of physical therapy or chiropractic treatment for neck or back pain.
3. Neurological conditions that may affect balance, motor control, or posture (e.g., stroke, multiple sclerosis).
4. Musculoskeletal pain or limitations unrelated to Forward Head Posture that could interfere with the intervention exercises.
5. Inability to attend scheduled intervention sessions or complete post-test assessments.

Data were analyzed using IBM SPSS Statistics version 27. Descriptive statistics (mean, standard deviation) were used to describe baseline characteristics. Paired sample t-tests were used to compare pre- and post-test results within each

group, while independent sample t-tests were applied for between-group comparisons. Statistical significance was set at $p < 0.05$.

This research was approved by the IKesT Muhammadiyah Palembang, under reference number 000646/KEP IKesT Muhammadiyah Palembang/2025. Prior to participation, all subjects were given a thorough explanation of the study's objectives, procedures, potential risks, and benefits. Written informed consent was obtained from all participants. Participation was voluntary, and respondents were assured of confidentiality and the right to withdraw from the study at any time without penalty.

RESULTS AND DISCUSSION

Table 1 presents the demographic characteristics of the study participants, consisting of 67 final-year students divided into Group A (n = 33) and Group B (n = 34). The gender distribution showed that females predominated in both groups, with 69.7% in Group A and 64.7% in Group B, though the difference was not statistically significant (p = 0.604). The mean age in Group A was 24.42 ± 0.82 years, slightly higher than Group B at 23.62 ± 0.91 years, and this difference was statistically significant (p = 0.014). The most common age category was 24 years, comprising 39.4% of Group A and 50% of Group B. These findings indicate comparable gender distribution across groups, but a notable difference in age, which may need to be considered in interpreting outcome measures.

Table 1. Distribution Among Participants

Variable	"Group A (n = 33)"	"Group B (n = 34)"	"Total (n = 67)"	p-Value
Gender, n (%)				0.604*
Female	23 (69.7%)	22 (64.7%)	45 (67.2%)	
Male	10 (30.3%)	12 (35.3%)	22 (32.8%)	
Age (years)				0.014
Mean ± SD	24.42 ± 0.82	23.62 ± 0.91	24.01 ± 0.93	
Age Distribution				
25 years old	15 (45.5%)	7 (20.6%)	22 (32.8%)	
24 years old	13 (39.4%)	17 (50.0%)	30 (44.8%)	
23 years old	3 (9.1%)	8 (23.5%)	11 (16.4%)	
22 years old	1 (3.0%)	3 (8.8%)	4 (6.0%)	

*p < 0.05 indicates statistically significant improvement

Table 2. Comparison of Pre-Test and Post-Test Scores Between Intervention and Control Groups

"Outcome Measure"	Group	Pre-Test (Mean ± SD)	Post-Test (Mean ± SD)	Mean Difference	p-value
Craniovertebral Angle(°)	Intervention	42.1 ± 2.5	49.3 ± 2.8	+7.2	0.000*
	Control	42.5 ± 2.3	43.1 ± 2.6	+0.6	0.081
Pain (Numeric Rating Scale)	Intervention	5.6 ± 1.2	2.1 ± 0.9	−3.5	0.000*
	Control	5.4 ± 1.1	4.9 ± 1.2	−0.5	0.074
Neck Disability Index (NDI) Score	Intervention	32.4 ± 4.7	15.3 ± 3.9	−17.1	0.000*
	Control	31.8 ± 5.1	29.6 ± 4.9	−2.2	0.096

*p < 0.05 indicates statistically significant improvement
CVA: Craniovertebral Angle (larger angle = improved posture)
NRS: Numeric Rating Scale for pain (0 = no pain, 10 = worst pain)
NDI: Neck Disability Index (lower score = less disability)

Table 2 presents the comparative analysis of pre-test and post-test outcomes between the intervention and control groups across three key measures: craniovertebral angle (CVA), pain intensity (measured using the Numeric Rating Scale), and functional disability (measured using the Neck Disability Index, NDI).

In the intervention group, there was a statistically significant improvement in posture, as evidenced by an increase in the mean craniovertebral angle from 42.1° ± 2.5° at baseline to 49.3° ± 2.8° after the intervention (p = 0.000). This indicates a measurable correction in forward head posture. In contrast, the control group showed only a minimal change from 42.5° ± 2.3° to 43.1° ± 2.6°, which was not statistically significant (p = 0.081).

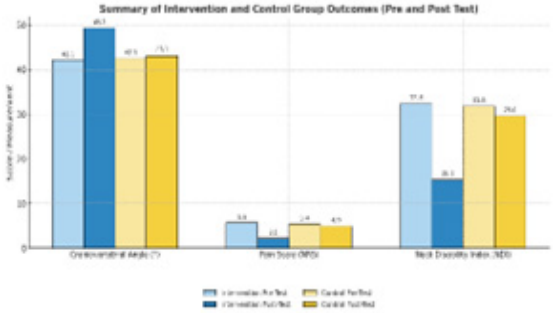
Pain intensity in the intervention group decreased markedly from 5.6 ± 1.2 to 2.1 ± 0.9, reflecting a mean reduction of 3.5 points (p = 0.000). Meanwhile, the control group demonstrated a non-significant reduction in pain scores from 5.4 ± 1.1 to 4.9 ± 1.2 (p = 0.074).

Similarly, the NDI scores in the intervention group declined substantially from 32.4 ± 4.7 to 15.3 ± 3.9, indicating a significant improvement in neck-related functional capacity (p = 0.000). The control group, however, showed only a slight and statistically insignificant reduction in NDI scores from 31.8 ± 5.1 to 29.6 ± 4.9 (p = 0.096).

Overall, the data strongly support the effectiveness of progressive strengthening exercises targeting the serratus anterior and rhomboid muscles in improving posture, reducing pain, and enhancing functional outcomes in individuals with Forward Head Posture.

The chart compares three key outcome measures: craniovertebral angle (CVA), pain in-

tensity (measured by the Numeric Rating Scale), and neck-related functional disability (measured using the Neck Disability Index). This chart visually reinforces the conclusion that progressive strengthening of the serratus anterior and rhomboid muscles is effective in improving postural alignment, reducing pain, and enhancing neck function in individuals with Forward Head Posture.



The findings of this study demonstrate that progressive strengthening of the serratus anterior and rhomboid muscles yields significant improvements in posture, pain reduction, and functional capacity among final-year students with Forward Head Posture (FHP). Specifically, the intervention group showed a marked increase in craniovertebral angle, indicating a correction of the head and neck alignment, while the control group showed negligible change. These results align with previous research suggesting that scapular stabilizing exercises can positively influence cervical spine posture by improving muscular activation and endurance around the shoulder girdle (Kang and Lin 2023; Lee et al. 2017).

Furthermore, the significant reduction in pain scores among the intervention group highlights the potential of targeted exercise in alleviating cervical discomfort associated with poor postural alignment (Bustam, I., G & Andini 2024). The mechanism behind this effect is likely multifactorial, involving enhanced neuromuscular control, reduced muscle strain, and improved biomechanical efficiency of the cervical-thoracic complex (Bustam 2024; Güler et al. 2022; Qian Gu, Tae-ho Kim 2019).

The improvement in functional disability, as evidenced by the decrease in NDI scores, also supports the clinical relevance of incorporating such interventions into rehabilitation or preventive programs for students and office workers exposed to prolonged static postures. The lack of significant changes in the control group reinforces the hypothesis that postural correction requires active and specific engagement of key muscle groups rather than passive observation (Baek et al. 2025; Nejati et al. 2014; Sepehri et al. 2024).

Nonetheless, several limitations must be acknowledged. The relatively short intervention period and lack of long-term follow-up restrict the generalizability of the results. Additionally, the respondents were limited to a single population final-year university students which may not reflect outcomes in other demographic groups. Future studies should explore broader respondents, incorporate electromyographic (EMG) analysis, and examine long-term retention of postural improvements.

CONCLUSION

This study confirms that progressive strengthening exercises targeting the serratus anterior and rhomboid muscles are effective in improving craniovertebral angle, reducing neck pain, and decreasing neck-related disability in individuals with Forward Head Posture. The findings support the implementation of specific scapular stabilization programs as a non-invasive and practical strategy to address postural dysfunctions in student populations. Early intervention and continued reinforcement of these corrective exercises may play a critical role in mitigating the long-term musculoskeletal consequences of poor postural habits.

REFERENCES

Abd-Elshafy, Asmaa Hosny, Gehan Hassan El-Meniawy, Wael S Abu El Azm, and Mahmoud S El Fakharany. 2022. "The Relation of Forward Head Posture with Back Muscle Endurance in Primary School Children: A Cross-Sectional Study." Bulletin of Faculty of Physical Therapy 27(1). doi:10.1186/s43161-022-00105-8.

Arooj, Ayesha, Aamir Aziz, Fariha Khalid, Muhammad Iqbal, and Huda Ashfaq. 2022. "Forward Head Posture in Young Adults: A Systematic Review." THE THERAPIST (Journal of Therapies & Rehabilitation Sciences): 32–35. doi:10.54393/tt.v3i1.38.

Baek, Chang-Yoon, Jung-Hoon Ahn, Jinyoung Lee, Hee-Hwa Lee, Woo-Taek Lim, Hye-Kang Park, and Hyeong-Dong Kim. 2025. "Effect of Digital Health Corrective Posture Exercise Program on Head and Shoulder Posture in Adolescents: A Cluster Randomized Controlled Trial." Medicine 104(12).

Bustam, I., G & Andini, S. 2024. "Penerapan Intervensi Microwave Diathermy (MWD) Dan Scapula Stabilization Exercise Pada Gangguan Gerak Dan Fungsi Leher Akibat Forward Head Posture (FHP)." Journal Health Applied Science And Technology (JHAST) 2(2): 103–7.

Bustam, Ika Guslanda. 2024. "Efektivitas Scapular

Stabilization Exercise Pada Kondisi Forward Head Posture Akibat Muscle Imbalance." 19(2): 95–102. doi:https://doi.org/10.35842/mr.v19i2.1165.

Güler, Mehmet, Barış NACIR, Burcu ÇAKIT, Hakan Genc, and Aynur KARAGÖZ. 2022. "Association Between Forward Head Posture and Scapular Dyskinesis in Patients with Non-Specific Chronic Neck Pain." Fiziksel Tıp ve Rehabilitasyon Bilimleri Dergisi 25: 279–85. doi:10.31609/jpmrs.2021-86922.

Kang, Fu-Jie, and Kun-Ying Lin. 2023. "Observing the Effect of Physical Activity on Forward Head Posture and Rounded Shoulder Posture in Young Healthy Adults." Journal of Physical Therapy Science 35(8). doi:10.1589/jpts.35.564.

Lee, Do Youn, Chan Woo Nam, Youn Bum Sung, Kyoung Kim, and Hae Yong Lee. 2017. "Changes in Rounded Shoulder Posture and Forward Head Posture According to Exercise Methods." Journal of Physical Therapy Science 29(10): 1824–27. doi:10.1589/jpts.29.1824.

Mostafaee, Neda, Nahid Pirayeh, Fatemeh HasanNia, Hossein Negahban, and Mahsa Kasnavi. 2024. "Examining Accuracy of and Determining the Best Cutoff Point for Photographic-Based Postural Angles to Discriminate between Slight and Moderate-to-Severe Forward Head Posture." Physiotherapy Theory and Practice 40(2). doi:10.1080/09593985.2022.2117581.

Nejati, Parisa, Sara Lotfian, Azar Moezy, Azar Moezy, and Mina Nejati. 2014. "The Relationship of Forward Head Posture and Rounded Shoulders with Neck Pain in Iranian Office Workers." Medical journal of the Islamic Republic of Iran 28: 26.

Poursadegh, Maryam, Mohammad Reza Azghani, Zahra Chakeri, Seyed Mehdi Okhravi, and Zahra Salahzadeh. 2023. "Postures of the Head, Upper, and Lower Neck in Forward Head Posture: Static and Quasi-Static Analyses." Middle East Journal of Rehabilitation and Health Studies 10(4). doi:10.5812/ME-JRH-136377.

Qian Gu, Tae-ho Kim, and Jung-genn Chun. 2019. "The Serratus Anterior Is One of the Most Important Muscle for Maintaining Good Scapular Alignment in the Shoulder Joint. The Pectoralis Major and Upper Trapezius May Also Compensate for Weak Serratus Anterior Muscles. The Push-up plus Exercise Has Been Id." 26(4): 29–34.

Savitri PA, Faidlullah HZ. "Risk Factors and Prevalence of Forward Head Posture Complaints Due to Use of Devices during Pandemic. Titafi [Internet]. 2022 Sep. 26 [Cited 2023 Oct. 22];. Available from: Https://Proceedings.Ifi.or.Id/Index.Php/Titafi/Article/View/10."

Sepehri, Simin, Rahman Sheikhhoseini, Hashem Piri, and Parisa Sayyadi. 2024. "The Effect of Various Therapeutic Exercises on Forward Head Posture, Rounded Shoulder, and Hyperkyphosis among People with Upper Crossed Syndrome: A Systematic Review and Meta-Analysis." BMC musculoskeletal disorders 25(1): 105. doi:10.1186/s12891-024-07224-4.

Stincel, Oana-Ruxandra, Mihaela Oravitan, Corina Pantea, Bogdan Almajan-Guta, Nicoleta Mirica, Alexandru Boncu, and Claudiu Avram. 2023. "Assessment of Forward Head Posture and Ergonomics in Young IT Professionals - Reasons to Worry?" La Medicina del lavoro 114(1): e2023006. doi:10.23749/mdl.v114i1.13600.

Swandari, Made, Ni Tianing, Anak Utama, and Parta Kinandana. 2023. "Forward Head Posture Dengan Keseimbangan Dinamis Pada Remaja Usia 13-14 Tahun Di Smpn 12 Denpasar-Cross Sectional Study." Majalah Ilmiah Fisioterapi Indonesia 11: 127. doi:10.24843/MIFI.2023.v11.i02.p11.