ORIGINAL ARTICLE

Physical Therapy Journal of Indonesia (*PTJI*) 2024, Volume 5, Number 2: 123-127
E-ISSN : 2722-6034 ; P-ISSN : 2722-0125

The effect of cervical stabilization and thoracic spine extension exercises on neck functional ability for forward head posture patients

Fitri Yani[1], Faradilla Windy Putri A. Gani[1*]

ABSTRACT

Background: The widespread usage of cell phones may encourage everyone to rely more on technology in all aspects of their lives. However, if technology use in daily tasks is not balanced with physical exercise, musculoskeletal problems may develop. The most common concern associated with this syndrome is forward head posture. This study aimed to determine whether giving cervical stabilization and thoracic spine extension exercises can increase neck functional ability for forward head posture patients.

Methods: The study used an experimental design. There were 23 physiotherapy students of Universitas 'Aisyiyah Yogyakarta as samples for this study, who had forward head posture and underwent measurement of neck functional ability by using the neck disability index (NDI). The independent administrator randomly assigned the treatment and control groups. The interventions were s conducted three times a week for four weeks. Data analysis employed a paired sample *T*-test to assess the effect of treatment and control groups. An independent sample *T*-test was used to compare the impact of treatments and control groups.

Results: The results of the paired sample *T*-test in treatment and control groups, with *p*-values=0.001, indicate that both interventions improved the functional ability of the neck. The difference between treatment and control groups tested by the independent sample *T*-test shows *p*-value=0.062 for the pre-test and (*p*-value=0.444), suggesting no difference in effectiveness between cervical stabilization and thoracic spine extension on neck functional ability for forward head posture conditions.

Conclusion: There was no difference in the effect of cervical stabilization and thoracic spine extension on the functional ability of the neck for forward head posture.

Keywords: Cervical stabilization, forward head posture, neck disability index, neck functional ability, thoracic spine extension.

Cite This Article: Yani, F., Gani, F.W.P.A. 2024. The effect of cervical stabilization and thoracic spine extension exercises on neck functional ability for forward head posture patients. *Physical Therapy Journal of Indonesia* 5(2): 123-127. DOI: 10.51559/ptji.v5i2.204

[1]Faculty of Health Sciences, Universitas 'Aisyiyah Yogyakarta.

*Corresponding author:
Faradilla Windy Putri A. Gani;
Faculty of Health Sciences, Universitas 'Aisyiyah Yogyakarta;
windygani203@gmail.com

Received: 2024-02-26
Accepted: 2024-06-03
Published: 2024-07-10

INTRODUCTION

Forward head posture (FHP) is a bad neck posture characterized by forward translation of the cervical vertebrae and hyperextension of the upper cervical vertebrae. Continuous FHP increases strain on posterior cervical structures, including ligaments, and alters scapular kinetics and kinematics. This can impact the quality of life and everyday activities.[1] The study found that the one-year incidence of neck discomfort ranged between 10.4% and 21.3%. Forward head position can cause visual and hearing problems due to muscle imbalances in the auditory meatus and temporomandibular disorders (TMD) caused by misalignment of the coronal line, which allows the jaw to slip forward. Migraine is also common in those who have FHP.[2]

Previous studies showed that cervical stability exercises improve FHP. Thoracic stretching exercises help improve postural alignment for FHP.[3] Several studies have investigated thoracic spine extension exercises for kyphosis. These exercises can reduce low back discomfort and improve lumbosacral alignment. Tests have shown breathing exercises to maintain appropriate posture and improve motion ability. They are now used as a preventative program. Breathing exercises can improve respiratory function and neck posture for individuals with FHP. Thoracic expansion exercises and abdominal breathing can enhance cranial rotation angle (CRA) and craniovertebral angles (CVA). Cervical stability exercises combined with breathing exercises have been linked to an increase in CVA.[4]

When using a gadget, the user typically positions their neck to look at a lower object and keeps their head in front for extended periods. Proper posture reduces lordosis in the lower cervical vertebrae and creates a posterior curvature in the upper thoracic vertebrae. Improper neck posture can alter the Center of Gravity

(COG), leading to balance issues and neck pain.[5,6] Based on the problems that often occur when associated with the current phenomenon, these problems can occur due to forward head posture conditions. The community of people vulnerable to posture disorders, such as FHP, comprises students. Students are a community of people always in contact with computers, laptops, and smartphones during various activities. Posture in doing tasks using a computer or smartphone for an extended period with a static body position can trigger dynamic stress and pain in the neck and shoulders. FHP often occurs when using gadgets or smartphones, carrying heavy bags, working in front of a computer, and using a sewing machine.[7]

FHP can occur due to external factors derived from activities carried out daily. Examples of activities that can cause FHP are using smartphones, laptops, and computers. Several studies have been conducted to find out the factors caused by the use of smartphones, laptops, and computers are closely related to the condition of FHP. The study states that the focus of the eyes when using a smartphone or computer for a long time causes the front curve or neck to become excessive in the lower cervical vertebrae and the back curve that exceeds the upper thoracic vertebrae, which makes the headstand forward. This posture that is too inclined towards the front can cause various problems and cause neck pain or discomfort.[8] Using the information supplied above, the researchers intended to study whether there were differences in the effects of cervical stability and thoracic spine extension exercises on neck functional ability in forward head position settings.

METHODS

This study used an experimental design with a pre and post-test two-group design. The independent variables in this study were cervical stabilization (Figure 1) and thoracic spine extension (Figure 2), and the dependent variable was neck functional ability. Observations and interviews on smartphones used on each subject were only done once. The data collection process in this study was carried out from December 2023 to January 2024. The population of physiotherapy students recorded from semesters 3-7 was 477 people with a vulnerable age of 20-23 years. The study included female physiotherapy students who were 20-23 years of age, enrolled in semesters 3 to 7 at Universitas 'Aisyiyah Yogyakarta, and signed an informed consent or letter of agreement to participate in the research. Male students and who do not undergo craniovertebral angle (CVA) measurements or have their NDI evaluated are excluded. There were 23 female students included in this study. The chosen subjects were then asked to sign an informed consent or letter of agreement to become research samples, and further CVA measurements were taken to assess the neck curve and neck disability index (NDI) to evaluate the functional limitations of the neck. This research was located at the Integrated Campus of Universitas 'Aisyiyah Yogyakarta.

The sampling technique in this study was randomized sampling. Each sample classified as having functional neck limitations was then calculated using the Slovin formula and randomly selected. This research began with an application for ethical clearance to the ethics commission of Universitas 'Aisyiyah Yogyakarta. It underwent various improvements to pass the ethical clearance test, and the ethical clearance with No. 3306/KEP-UNISA/XII/2023 was obtained. Then, we contacted each sample or subject selected for this study to sign a statement of consent to become a research subject. Furthermore, the research subjects were asked to attend the training room provided by the researcher to carry out the intervention or exercise.

Forward head posture in this study was measured using the NDI. This measuring instrument was used to determine whether there were functional limitations in individuals with FHP conditions. The NDI measurement contained ten questions about pain and daily activities: self-care, lifting, reading, headaches, concentration, work, driving a car, sleep, and recreation.[9] This intensity questionnaire had specific questions on the severity of disability when performing certain activity levels. This measurement was designed to be given to patients by filling out a questionnaire so that it could provide helpful information on the treatment or prognosis of those suffering from neck disability.[10]

The NDI score could be either numerical or in the form of a message. The Neck Disability Indexes consisted of ten sections, each with a value of 0 to 5. These were then summed to reach the highest number of fifty. For percentages, if the assessment questionnaire was filled out, then the total maximum score for the assessment multiplied by 2 (100) became 100. If all assessments were not filled out, the total divisor was the number filled out multiplied by 5. The score categories on the NDI consisted of 0-4 (0-8%) no disability, 5-14 (10-28%) mild disability, 15-24 (30-48%) moderate disability, 25-34 (50-68%) severe disability, 35-50 (70-100%) complete disability. In this study, the NDI value obtained by the average subject was 5-14 (10-28%) within the mild disability category.[11]

RESULTS

Data were collected and analyzed using Hypothesis Tests I and II with the Paired Sample *T*-test and Hypothesis Test III with the Independent Sample *T*-test. The results are presented in the table below. Table 1 shows that the age group with the highest number of research subjects was the control group, namely 20-21 years, with a total of 9 students (75%), while the lowest number was also in the control group, consisting of 3 students (25%). The characteristics of the subjects based on gender showed that the study was dominated by females, with 23 students (100%). Regarding smartphone use, the highest duration in each group was 3-5 hours, with nine people in group I (81.8%) and nine in group II (75%). The treatment group had the shortest period of smartphone use, with only two participants (18.2%) spending more than five hours.

Table 2 shows the characteristics of subjects based on Pre and Post NDI values. The difference in NDI values in the treatment group (1.91 ± 0.511) and control group (2.92 ± 0.052) show an increase in NDI values from each group. Table 3 shows the results of the Hypothesis Test I analysis using the Paired Sample *T*-test, which yielded a *p*-value of 0.001. Since $p<0.05$, Hypothesis I (Ha) was accepted, and the null Hypothesis (Ho) was rejected. It can be concluded that cervical stabilization

training affects the functional ability of physiotherapy students' necks in forward head posture conditions. Hypothesis Test II analysis using the Paired Sample *T*-test yielded a *p*-value of 0.001. Since $p<0.05$, Hypothesis II (Ha) was accepted, and the null Hypothesis (Ho) was rejected. It can be concluded that thoracic spine extension exercises affect the functional ability of the neck in forward head posture conditions.

Table 4 shows the results of Hypothesis Test III analysis using the Independent Sample *T*-test. The NDI values for the treatment and control groups yielded a pre-test *p*-value of 0.062 and a post-test *p*-value of 0.444, indicating that $p>0.05$. Thus, the null Hypothesis (Ho) is accepted, and the alternative Hypothesis (Ha) is rejected. It can be concluded that there is no significant difference in the effect of cervical stabilization exercises and thoracic spine extension exercises on the functional ability of the neck in physiotherapy students with forward head posture conditions.

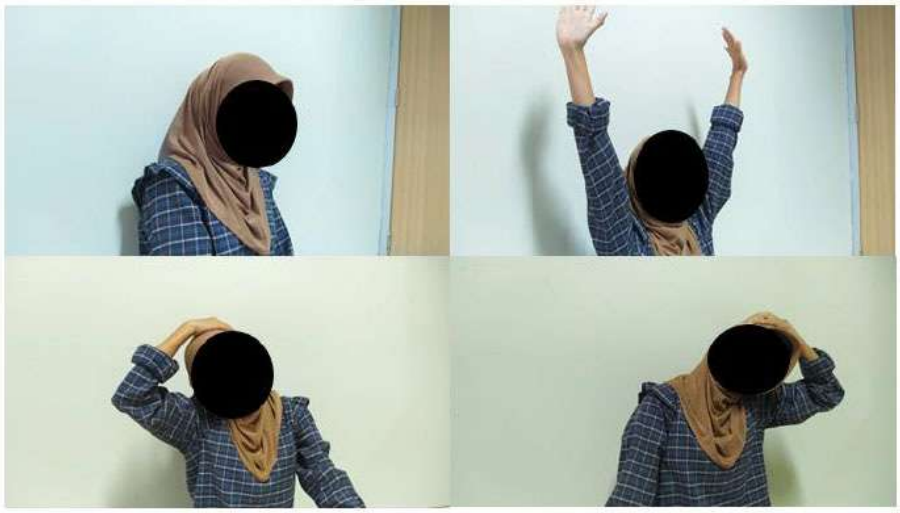

Figure 1. Cervical stabilization exercises.

Figure 2. Thoracic spine extension exercises.

DISCUSSION

The female gender tends to have high activity in various activities, such as housework, social activities, and religion. This makes women more at risk of musculoskeletal problems.[12] The discussion above can be supported by other studies that examine higher physical activity and the factors of musculoskeletal events in batik workers. The results showed that female workers experienced more MSD_s complaints than male workers, with the female gender at a percentage of 88.9% and the male gender at a rate of 11.1% experiencing musculoskeletal problems. The data obtained in the study shows that females have more musculoskeletal problems during activities than males. Compared with this study, they were dominated by females with musculoskeletal issues, especially in the case of forward head posture.[13]

From the distribution of age data, it can be seen that the age of 20-23 years is a very productive period for late adolescents, who have begun to feel the density of outside activities or activities. So, with the vulnerable age leading to adulthood, people cannot control themselves and continue to explore everything until they pay less attention to activities that can wash musculoskeletal problems, such as forward head posture.[14,15]

This study compares the effectiveness

Table 1. Frequency distribution of characteristics of research subjects based on age, gender, duration of smartphone use

Characteristic	Treatment Group	Frequency	Control Group	Frequency
Gender				
Female	11	100	12	100
Age				
20-21 Years	5	45.5	9	75
22-23 Years	6	54.5	3	25
Smartphone Usage Duration				
3-5 hours	9	81.8	9	75
>5 hours	2	18.2	3	25

Table 2. Frequency distribution of research subject characteristics based on neck disability index (NDI) values, hypothesis test I and I using paired sample *T*-test analysis, and hypothesis III test using independent sample *T*-test analysis

Variable	Mean+SD	Difference or *p*-value
NDI Value		
Treatment Group		
Pre-test	7.00+1.732	1.91+0.511
Post-test	5.09+1.221	
Control Group		
Pre-test	7.67+1.107	2.92+0.052
Post-test	4.75+1.055	
Hypothesis Test I and I		
Treatment Group	1.909+1.044	0.001
Control Group	2.917+0.793	0.001
Hypothesis Test III		
Pre-test I and II	7.35+1.434	0.062
Post-test I and II	4.91+1.125	0.444

of cervical stabilization and thoracic spine extension exercises on forward head posture. The results obtained in this study indicate that cervical stabilization exercises and thoracic spine extension exercises have the same advantages in improving neck functional abilities.[16] The distribution data of smartphone use shows that the average sample a day can use a smartphone> 3-6 hours to spend on a personal smartphone. In another study conducted, it was found that FHP occurred in smartphone users who spent >4 hours/day.[17]

Based on this explanation, compared to this research, each respondent's smartphone use duration is at risk of experiencing FHP conditions, ranging from 3-6 hours. This can make a person able to experience FHP conditions if not immediately given education or treatment. It will cause various other musculoskeletal problems.[18] A person with FHP conditions must have neck functional limitations experienced so that measuring using the NDI measuring instrument can help determine how much functional neck limitations occur so that treatment can be given to improve functional abilities. Neck Disability Index or NDI is a measuring tool to assess the functional limitations of the neck experienced by a person.[19]

Differences in the effect of cervical stabilization and thoracic spine extension found that cervical stabilization training affects the functional ability of the neck. The study examined the effectiveness of cervical stabilization exercises on the respiratory condition of patients with neck pain and FHP head position. This study found that someone with FHP had weakness in several muscles, namely, the lower trapezius, serratus anterior, rhomboids, and shortening and tightening of the cervical extensor or pectoralis muscle so that it can cause decreased strength and fatigue of the cervical muscles, reduced mobility of postural abnormalities and decreased lung function.[20]

FHP is a condition where the position of the head increases cervical lordosis and thoracic kyphosis as a result of the changes that occur, causing weakness of the inspiratory muscles, decreased respiratory strength, reduced chest development, and increased work of breathing, which results in damaged lung function such as vital capacity, and maximum inspiratory and respiratory pressure.[21]

This study has several limitations. Firstly, the specific population studied (e.g., physiotherapy students) may not represent the broader population. Consequently, the findings may not apply to other groups or settings. Second, this study's design primarily captures the short-term effects of the interventions. Long-term impacts and the sustainability of the improvements observed are not addressed. Third, the analysis relies on self-reported measures like the NDI. Self-reported data can be subject to biases, including social desirability bias and recall bias, which may affect the accuracy of the results.

CONCLUSION

There was no difference in the effect of cervical stabilization and thoracic spine extension exercises on the functional ability of the neck in forward-head posture conditions. Future research should aim to diversify the study population beyond physiotherapy students, incorporate longitudinal designs to assess long-term impacts and sustainability of interventions and utilize objective outcome measures in addition to self-reported data such as the NDI, mitigating potential biases and enhancing the accuracy of the findings.

ETHICAL CLEARANCE

Health Research Ethics Commission, Faculty of Health Sciences, Universitas 'Aisyiyah Yogyakarta, No.3306/KEP-UNISA/XII/2023.

CONFLICT OF INTEREST

This research does not have any conflicts of interest.

FUNDING

This research has received no special funding from any funding agency in the public, commercial, or non-profit sectors.

AUTHOR CONTRIBUTIONS

FY created the study's methodology, collected data, and produced the publication. FWPAG performed a literature search, edited the manuscript, and reviewed the final version of the paper.

REFERENCES

1. Koseki T, Kakizaki F, Hayashi S, Nishida N, Itoh M. Effect of forward head posture on thoracic shape and respiratory function. J Phys Ther Sci. 2019; 31(1): 63-8.
2. Arooj A, Aziz A, Khalid F, Iqbal MH, Ashfaq HB. Forward head posture in young adults: a systematic review. Therapist J Ther Rehabil Sci. 2022; 3(1): 32-5.
3. Pawaria S, Sudan DH, Kalra S, Yadav J. Effectiveness of cervical stabilization exercises with feedback on respiratory status in chronic neck pain patients with forward head posture. Int J Physiother. 2019; 6(3): 70-5.
4. Yu LJ, Kim TH. The effect of cervical stabilization exercises with thoracic spine extension exercises on forward head posture. Int J Hum Mov Sports Sci. 2021; 9(5): 852-7.

5. Agatha S, Thanaya SAP, Sundari LPR, Nugraha MHS. Overview of musculoskeletal disorders in Undergraduate Students. Physical Therapy Journal of Indonesia. 2022; 3(2): 49–53.
6. Arti W, Tenriwulan AF, Anjasmara B. Effectiveness of ultrasound addition in intervention McKenzie's neck exercise reduces mechanical neck pain. Physical Therapy Journal of Indonesia. 2023; 4(1): 1–5.
7. Swandari MI, Tianing NW, Septian Utama AAGE, Kinandana GP. Forward head posture dengan keseimbangan dinamis pada remaja usia 13-14 tahun di SMPN 12 Denpasar-Cross Sectional Study. Majalah Ilmiah Fisioterapi Indonesia. 2023; 11(2): 169-174.
8. Choi W. Effect of 4 weeks of cervical deep muscle flexion exercise on headache and sleep disorder in patients with tension headache and forward head posture. Int J Environ Res Public Health. 2021 ;18(7): 1-11.
9. Wahyuni NN, Wijaya TF, Adeel M Adhitya IPGS. Higher duration of laptop usage associated with neck disability in Undergraduate Physical Therapy Students During the Covid-19 Pandemic. Physical Therapy Journal of Indonesia. 2022; 3(1): 6–10.
10. Putra IPM, Nugraha MHS, Tianing NW, Primayanti IDAID. Lintas budaya kuesioner neck disability index versi Indonesia pada mechanical neck pain. Majalah Ilmiah Fisioterapi Indonesia. 2020; 6(3): 34–9.
11. Dharma IKDW, Andika NWT, Dewi NLAC, Paramurthi IAP, Kurniawati, I. Online Game Duration Associated to Neck Functional Disability in Esports Athletes. Physical Therapy Journal of Indonesia. 2020; 1(2): 26-8.
12. Norouzi S, Tavafian SS, Cousins R, Mokarami H. Understanding risk factors for musculoskeletal disorders in Iranian homemakers: Developing a comprehensive health promotion behavior model. BMC Public Health. 2023; 23(1): 1-13.
13. Santosa A, Ariska DK. Faktor-faktor yang berhubungan dengan kejadian musculoskeletal disorders pada pekerja Batik di Kecamatan Sokaraja Banyumas. Jurnal Ilmiah Ilmu-ilmu Kesehatan. 2018; 16(1): 42–6.
14. Alowa Z, Elsayed W. The impact of forward head posture on the electromyographic activity of the spinal muscles. J Taibah Univ Med Sci. 2021; 16(2): 224–30.
15. Knoll LJ, Leung JT, Foulkes L, Blakemore SJ. Age-related differences in social influence on risk perception depend on the direction of influence. J Adolesc. 2017; 60: 53–63.
16. Yu LJ, Gu Q, Kim TH. Effects of cervical stabilization exercises with thoracic spine extension exercises on the cervical range of motion of men and women with forward head posture. J Pharm Negat Results. 2022; 13(8): 3380–6.
17. Jung SI, Lee NK, Kang KW, Kim K, Lee DY. The effect of smartphone usage time on posture and respiratory function. J Phys Ther Sci. 2016; 28(1): 186–9.
18. Kim SY, Koo SJ. Effect of duration of smartphone use on muscle fatigue and pain caused by forward head posture in adults. J Phys Ther Sci. 2016; 28(6): 1669–72.
19. Howell ER. The association between neck pain, the Neck Disability Index and cervical ranges of motion: a narrative review. J Can Chiropr Assoc. 2011; 55(3): 211–21.
20. Pawaria S, Sudan DS, Kalra S, Yadav J. Effectiveness of cervical stabilization exercises. International Journal of Physiotherapy. 2019; 6(3): 70–4.
21. Kang NY, Im SC, Kim K. Effects of a combination of scapular stabilization and thoracic extension exercises for office workers with forward head posture on the craniovertebral angle, respiration, pain, and disability: A randomized controlled trial. Turk J Phys Med Rehabil. 2021; 67(3): 291–9.