OPEN ACCESS

Original Article

DOI: 10.55735/hjprs.v4i6.292

The Healer Journal of Physiotherapy and Rehabilitation Sciences

HJPRS

SCAN ME

Journal homepage: www.thehealerjournal.com

Thoracic Mobilization Versus Sling-Based Thoracic Active Exercises on Pain, Function and Quality of Life in Patients with Non-specific Neck Pain

Samer Zehra[1], Muhammad Sarfraz[2], Hafsa Chandio[1], Iqra Waseem[1*], Ayesha Naeem[1], Amjed Ali[1]

[1*]University Institute of Physical Therapy, University of Lahore, Lahore, Pakistan
[2]Physiotherapy Department, Dow University of Health Sciences, Karachi, Pakistan

KEYWORDS

Non-specific neck pain
Sling-based exercises
Thoracic mobilisation

DECLARATIONS

Conflict of Interest: None

Funding Source: None

CORRESPONDING AUTHOR

Iqra Waseem
University Institute of Physical Therapy, University of Lahore, Lahore, Pakistan.
iqra.waseem@uipt.uol.edu.pk

ABSTRACT

Background: Non-specific neck pain is the type of neck pain which has no pathognomonic signs and symptoms or has no underlying condition. It is estimated that 70% of the population may suffer from non-specific neck pain at some point in their life. **Objective:** To find out the effects of thoracic mobilization versus sling-based thoracic active exercises on pain, function and quality of life in patients with non-specific neck pain. **Methods:** This randomized trial was conducted at the Physiotherapy Department of the University of Lahore Teaching Hospital. Participants aged 20 to 45 years, diagnosed patients of non-specific neck pain were included in the study. Patients with any neurological disease, previous surgical history, pregnancy, or cardiac disease were excluded. Group A performed cervical manual therapy for and sling-based active thoracic exercises. While Group B performed cervical manual therapy and thoracic mobilization. A numeric pain rating scale, neck disability index and short form-36 questionnaire were used to measure pain, function and quality of life respectively. Mann-Whitney U and Friedman tests were applied to identify within-group differences in both groups. **Results:** The mean rank for pain score in group A at the baseline was 31.42 and in group B 21.58 with a Z value of -2.437 and a p-value is 0.015. At the end of the treatment 4th week, the mean rank for pain in group A was 16.65 and in group B 36.35 with a Z-value of -4.851 and a p-value is 0.00. The mean rank for neck disability index score in group A at the baseline was 27.94 and in group B 25.06 with a Z-value of -1.158 and p-value is 0.247. At the end of the treatment 4th week, the mean rank for disability score in-group A was 22.5 and in-group B 30.5 with a Z-value of -3.045 and a p-value is 0.02. **Conclusion:** Both groups showed significant improvements but Group A had more pronounced effects. Thoracic mobilization provides faster short-term relief but the active nature of sling-based exercises offers more sustainable benefits in long-term management of pain and patient wellbeing.

How to cite the article: Zehra S, Sarfraz M, Chandio H, Waseem I, Naeem A, Ali A. Thoracic Mobilization Versus Sling-Based Thoracic Active Exercises on Pain, Function and Quality of Life in Patients with Non-specific Neck Pain. The Healer Journal of Physiotherapy and Rehabilitation Sciences. 2024;4(6):1-8.

INTRODUCTION

Non-specific neck pain refers to discomfort in the lateral and posterior neck that lacks pathognomonic signs and symptoms. It is a prevalent condition with a significant effect and socioeconomic cost. The number of prevalent instances of neck pain globally was projected to be 288.7 million, with roughly 28.6 million years lived with disability related to neck pain in 2017.[1] Non-specific neck pain (NSNP) is the most frequent musculoskeletal condition.[2] Neck pain is the fourth main cause of musculoskeletal disorders worldwide.[3] It is predicted that over 70% of the population may have neck discomfort at some point in their lives, with an annual incidence ranging from 15% to 50%.[4] Neck pain frequently coexists with chronic musculoskeletal problems locally and regionally.[5] It is more prevalent in middle-aged females,[6] and it is widely documented that NSNP is not only a risk factor for developing severe spinal pathologies and functional impairment,[7] but it is also linked to lower worker quality of life and productivity.[8]

Old age, prolonged sitting hours, stress from work and female gender are the most common risk factors that result in the development of neck pain.[9,10] Neck pain has increased by six times in office workers due to the overuse of smartphones. Females are more affected by neck pain due to reduced muscle strength and reported 65% more upper extremity problems than males, i.e., 56%, in the previous years.[11] The thoracic spine supports the cervical spine and regulates its kinematics via the cervicothoracic junction. Several studies have shown the influence of thoracic spine anomalies on cervical spine kinematics. In particular, mobility constraints in the cervicothoracic and upper thoracic areas have been linked to neck discomfort. Furthermore, it has been shown that the occurrence of neck diseases increases with age, as does the prevalence of thoracic hyperkyphosis.[12]

There is no one remedy for neck discomfort. However, several pharmaceutical and non-pharmacological therapies, such as laser therapy, massage, acupuncture, yoga, and aquatic therapy, have been advised.[13] Manual therapy and instrument-assisted soft tissue mobilization[14] can help persons with neck discomfort improve their pain and function.[15] Disruptions in the biomechanics of the thoracic spine, which has an intrinsic biomechanical relationship with the cervical spine, might be the main cause of neck discomfort. Thoracic manipulations for neck discomfort can produce rapid improvements in neck function. As an addition to therapy, thoracic manipulation may be a useful choice for increasing cervical flexion and rotation. Thoracic manipulation is just as effective as cervical manipulation in terms of pain relief and function improvement.[16]

Non-thrust mobilizations and thoracic thrust mobilizations have been proven to improve the severity of neck discomfort, neck motions, and self-reported impairment. Thoracic manipulation, either alone or in conjunction with other physiotherapy therapies, was used to alleviate cervical spine discomfort, enhance function, and increase cervical range of motion (CROM). Evidence is emerging in favour of thoracic spine thrust manipulation as a treatment for non-specific neck pain and acute mechanical neck pain.[17] Exercising with a sling is an active exercise technique in which the person actively works, as opposed to a passive approach, and it may also be efficiently conducted with a closed-chain workout, which is a good way for functional mobility or joint stabilization. Closed-chain workouts enhance joint compression force by weight bearing and activate the joint receptor to improve joint position awareness and its influence on linked muscles[18] The sling exercise treatment, as a training program, focuses not only on strengthening the trunk and limb muscles but also on activating the proprioceptors, which increases neuromuscular system synchronization.[19]

To maximize its therapeutic impact for motor control training, sling exercise employs several components, including rope level, vibration, and location. Sling exercise involves fully supporting a single or many parts of the patient's body with specifically made ropes to allow painless activity or to help alleviate current discomfort. The ropes are put up in such a way that the patient may utilize his or her body weight as resistance for training while freeing up the therapist's hands for physical facilitation.[20] This study compares thoracic mobilization and sling-based thoracic active exercises to clarify effectiveness in reducing pain and improving function and to inform evidence-based guidelines. It investigates whether thoracic mobilization is more effective

than sling-based thoracic active exercise or whether sling-based exercises improve the outcomes more. This study provides valuable insight into the optimal treatment strategy for non-specific neck pain.

METHODOLOGY

This study was a randomized controlled trial conducted at the Physiotherapy Department of the University of Lahore Teaching Hospital, Lahore. The sample size was calculated using the mean pain score in the STAET group (3.43+0.76) and the Control group (4.08+0.76) The sample size is 52 (26 in each group). Non-probability purposive sampling was used to collect data. The inclusion criteria were both males and females aged 20-45 years, diagnosed patients of non-specific neck pain and a neck disability index score equal to or more than 24. The exclusion criteria were the presence of neurological signs and symptoms, previous surgical history related to the spine or neck, pregnancy, cardiac disease and any active infection.

After randomly allocating the participants into two intervention groups through the lottery method, Group A performed cervical manual therapy for 20 minutes and sling-based active thoracic exercise for 20 minutes a day, 3 times a week, for 4 weeks. Group B performed cervical manual therapy for 20 minutes and thoracic mobilization for the same duration. The sling-based exercise program used in this study is inspired by the Nurac1 seminar workbook.[21] Pain, function and quality of life were studied. The degree of pain was evaluated at baseline, 2nd and 4th week (after the treatment) by a numeric pain rating scale (NPRS). The NDI was used to examine neck function at baseline, 2nd and 4th week (after the treatment). The short-form SF-36 questionnaire was used to evaluate the quality of life at baseline, 2nd and 4th week (after the treatment). Mann-Whitney U and Friedman tests were applied to identify within-group differences in both groups.

RESULTS

The descriptive statistics of demographic variables showed that in Group A, the mean age is 32.30 years, with a standard deviation of 5.92. 12 (46.2%) had the right-effected side, 10 (38.5%) had the left-effected side, and only 4 (15.4%) had both sides affected. In Group B, the mean age is 36.34 years, with a standard deviation (SD) of 6.64. 13(50%) had the right-effected side, 7 (26.9%) had the left-effected side and only 6 (23.1%) had both sides affected.

Group A generally had a higher frequency and percentage of participants with symptoms in the earlier weeks, such as 2 weeks (19.2% vs. 11.5%) and 4 weeks (23.1% vs. 19.2%) compared to Group B. However, as the duration extended, Group B began to show a higher frequency and percentage, particularly at 5 and 6 months (7.7% each in Group B, compared to 0.0% and 3.8% in Group A, respectively).

The normality of data was investigated with the Kolmogorov-Smirnov test, which showed that most of the variables at different intervals have insignificant p-values (less than 0.05) which lightens up the non-normal distribution of the data around the means. Descriptive statistics of NPRS and NDI show that both groups experience a reduction in pain, measured by NPRS, from baseline treatment to week 2 and week 4 treatment. Group A shows more significant improvements, in the week 4 treatment, functional abilities compared to Group B. Overall, both groups demonstrate positive trends, but Group A shows more pronounced improvements in key variables and more significant improvements, in the week 2 and week 4 treatment, in domain of quality of life Physical Functioning, Role limitation due to physical health, emotional problem, Emotional wellbeing, Social functioning, Pain, Energy/Fatigue and General health by increase the mean value of these domain.

DISCUSSION

This study aimed to explore the effects of thoracic mobilisation versus sling-based thoracic active exercises on pain, function, and quality of life in patients with non-specific neck pain. Both interventions demonstrated positive outcomes in reducing pain, improving functional capacity, and enhancing overall quality of life. In comparing our study with that of Mahmoudabadi et al. (2024), who investigated neck stabilization exercises with and without thoracic mobility it was seen that a shared emphasis on improving disability and range of motion in patients with chronic neck pain. Mahmoudabadi's findings showed that adding the range of motion and muscular endurance.[22] Similarly, our study

Table 1: Friedman test for pain, functional disability and quality of life at three intervals in groups A and B (Within-group)

		Group A			Group B		
		Mean Rank	Chi-square	p-value	Mean Rank	Chi-square	p-value
NPRS	Baseline	3.00	52.000	0.00	2.98	50.060	0.00
	Week 4	1.00			1.06		
NDI NDI	Baseline	2.92	44.744	0.00	2.73	36.557	0.00
	Week 4	1.27			1.27		
Physical Functioning	Baseline	1.21	42.961	0.00	1.15	38.574	0.00
	Week 4	2.98			2.79		
Role limitation due to physical health	Baseline	1.17	42.860	0.00	1.56	15.621	0.00
	Week 4	2.94			2.37		
Role limitation due to emotional problem	Baseline	1.17	45.267	0.00	1.73	5.491	0.06
	Week 4	2.90			2.17		
Emotional wellbeing-Base	Baseline	1.25	35.820	0.00	1.38	21.558	0.00
	Week 4	2.87			2.62		
Social functioning	Baseline	1.40	30.809	0.00	1.38	24.400	0.00
	Week 4	2.79			2.40		
Pain	Baseline	1.15	41.725	0.00	1.40	17.622	0.00
	Week 4	2.92			2.46		
Energy/Fatigue	Baseline	1.54	9.634	0.008	1.52	10.556	0.005
	Week 4	2.31			2.29		
General Health	Baseline	1.46	22.333	0.00	1.33	21.837	0.00
	Week 4	2.69			2.25		

found that participants in Group A experienced better functional outcomes and greater improvements in pain levels. These findings align with Mahmoudabadi's results, where more active thoracic involvement was seen. In our study, sling-based thoracic exercises showed more beneficial results for pain management and functional recovery in such patients.

Similarly, Seo et al conducted a study in 2022 comparing the effects of thoracic spine manipulation (TSM) and thoracic mobility exercises (TSME) in office workers. These office workers were with chronic neck pain. Findings of this study showed that both the interventions were effective but our study showed that sling-based thoracic exercises yield more pronounced improvements in functional disability and quality of life.[23] While Seo's study focused on TSM and TSME in a controlled setting, our study incorporated a more dynamic, patient-engaged intervention in Group A, which may account for the more significant functional gains in our results, especially in the quality-of-life domains.

Joshi et al. (2020) explored the effects of cervicothoracic junction mobilization versus mid-thoracic manipulation in patients with neck pain and found improvements in cervical range of motion and pain in both groups, with no significant differences between them.[24] In our study, while both groups demonstrated improvements, Group A showed superior results, particularly in pain reduction and

Table 2: Mann Whitney U Test (Between-group analysis of pain and functional disability)

Variables		Treatment Groups	Mean Rank	Sum of Ranks	Mann Whitney U test Z-value	p-value
NPRS	Baseline	Group A	31.42	817.00	-2.437	.015
		Group B	21.58	561.00		
	Week 4	Group A	16.65	433.00	-4.851	.000
		Group B	36.35	945.00		
NDI	Baseline	Group A	27.94	726.50	-1.158	.247
		Group B	25.06	651.50		
	Week 4	Group A	22.50	585.00	-3.045	.002
		Group B	30.50	793.00		

functional outcomes. This discrepancy may be due to the more active engagement in our sling-based thoracic exercises, which likely fostered more sustainable improvements in the patient's daily functioning and quality of life.

Park et al in a 2021 study on the effects of sling-based thoracic active exercise on neck pain and quality of life found significant improvements in both pain and function, consistent with the findings of our study. Both studies emphasize the importance of thoracic treatment in improving neck pain, with sling-based exercises demonstrating a more substantial impact on functional outcomes.[21] Similar to our study, Park's results showed that sling-based exercises, combined with cervical manual therapy, significantly reduced pain and improved quality of life, particularly in domains such as physical functioning and emotional well-being.

In 2020, Madiha Saddique et al did another research in which the thoracic mobilisation along with cervical thoracic mobilisation combined effect was assessed in patients with neck pain. Results of the study showed that there is no significant difference between the group with which one was given thoracic mobilisation and the other was given combined therapy of cervical thoracic mobilisation and thoracic mobilisation. Results showed that for pain reduction and range of motion improvement, both groups showed similar effects. The study indicates that thoracic mobilisation improves pain in neck pain patients. On the contrary, our study states that sling-based thoracic active exercise when combined with cervical manual therapy offers much better results in improving pain as well as functional improvement along with quality of life. More findings that are significant were seen in the intervention group with combined therapy in comparison to thoracic mobilisation alone. Based on this it was stated that sling-based thoracic exercises may facilitate better opportunities for muscle activation as well as in improving functional capacity.[25]

Our study suggests that sling-based thoracic active exercises, combined with cervical manual therapy, offer superior outcomes in both pain reduction and functional improvement compared to thoracic mobilization alone. The active engagement of the thoracic spine in Group A appears to provide more lasting benefits, particularly in quality-of-life domains such as physical functioning, emotional well-being, and social functioning, underscoring the importance of incorporating active thoracic exercises in the treatment of neck pain. These findings are consistent with previous research, reinforcing the idea that active patient involvement in thoracic exercises can lead to more substantial improvements in functional capacity and overall well-being.

CONCLUSION

It was found that sling-based thoracic active. exercises significantly reduced pain and functional disability and improved the quality of life of the patients with non-specific neck pain. Significant differences were observed between groups in terms of the outcome measures Although thoracic mobilization provides faster short-term relief, the active nature of sling-based

Table 3: Mann Whitney U Test (Between-group analyses of SF-36 Domains)

Variables		Treatment Groups	Mean Rank	Sum of Ranks	Mann Whitney U test Z-value	p-value
Physical Functioning	Baseline	Group A	26.46	688.00	-.019	.985
		Group B	26.54	690.00		
	Week 4	Group A	38.23	994.00	-5.622	0.00
		Group B	14.77	384.00		
Role limitation due to physical health	Baseline	Group A	22.04	573.00	-2.359	.018
		Group B	30.96	805.00		
	Week 4	Group A	38.46	1000.00	-5.920	0.00
		Group B	14.54	378.00		
Role limitation due to emotional problem	Baseline	Group A	20.92	544.00	-2.978	0.003
		Group B	32.08	834.00		
	Week 4	Group A	38.42	999.00	-5.981	0.00
		Group B	14.58	379.00		
Emotional wellbeing	Baseline	Group A	25.06	651.50	-.692	.489
		Group B	27.94	726.50		
	Week 4	Group A	35.17	914.50	-4.162	0.00
		Group B	17.83	463.50		
Social functioning	Baseline	Group A	29.73	773.00	-1.594	.111
		Group B	23.27	605.00		
	Week 4	Group A	37.29	969.50	-5.607	0.00
		Group B	15.71	408.50		
Pain	Baseline	Group A	25.31	658.00	-.587	.557
		Group B	27.69	720.00		
	Week 4	Group A	38.00	988.00	-5.636	0.00
		Group B	15.00	390.00		
Energy/fatigue	Baseline	Group A	26.69	694.00	-.094	.925
		Group B	26.31	684.00		
	Week 4	Group A	29.31	762.00	-1.353	.006
		Group B	23.69	616.00		
General Health	Baseline	Group A	32.60	847.50	-3.002	.003
		Group B	20.40	530.50		
	Week 4	Group A	36.98	961.50	-5.048	0.00
		Group B	16.02	416.50		

exercises offers broader, more sustainable benefits, especially in the long-term management of pain and overall patient well-being.

DECLARATIONS

Consent to participate: Written consent had been taken from patients. All methods were performed following the relevant guidelines and regulations.

Availability of data and materials: Data will be available on request. The corresponding author will submit all dataset files.

Competing interests: None

Funding: No funding source is involved.

Authors' contributions: All authors have read and approved the final manuscript.

CONSORT Guidelines: All methods were performed following the relevant guidelines and regulations.

REFERENCES

1. Bernal-Utrera C, Gonzalez-Gerez JJ, Anarte-Lazo E, Rodriguez-Blanco C. Manual therapy versus therapeutic exercise in non-specific chronic neck pain: a randomized controlled trial. Trials. 2020 Jul 28;21(1):682.
2. Khan ZK, Ahmed SI, Baig AAM, Farooqui WA. Effect of post-isometric relaxation versus myofascial release therapy on pain, functional disability, ROM and QoL in the management of non-specific neck pain: a randomized controlled trial. BMC Musculoskelet Disord. 2022 Jun 13;23(1):567.
3. Jun D, Johnston V, McPhail SM, O'Leary S. A Longitudinal Evaluation of Risk Factors and Interactions for the Development of Nonspecific Neck Pain in Office Workers in Two Cultures. Hum Factors. 2021 Jun 1;63(4):663–83.
4. Jun D, Johnston V, McPhail SM, O'Leary S. A Longitudinal Evaluation of Risk Factors and Interactions for the Development of Nonspecific Neck Pain in Office Workers in Two Cultures. Hum Factors. 2021 Jun 1;63(4):663–83.
5. Waseem I, Tanveer F, Fatima A. Conventional physical therapy with low-level laser therapy on pain and functional disability in patients of upper trapezius muscle trigger point. Rawal Medical Journal. 2020 Oct;45(4):854-6.
6. Waseem I, Tanveer F, Fatima A. Conventional physical therapy with low-level laser therapy on pain and functional disability in patients of upper trapezius muscle trigger point. Rawal Medical Journal. 2020 Oct;45(4):854-6.
7. Derakhshanrad N, Yekaninejad MS, Mehrdad R, Saberi H. Neck pain associated with smartphone overuse: cross-sectional report of a cohort study among office workers. Eur Spine J. 2021 Feb 1;30(2):461–7.
8. Waseem I, Tariq K, Salam A, Mahmood T, Tabassum M. Prevalence of neck pain and its contributing factors among ophthalmologists of Faisalabad, Pakistan. Rawal Medical Journal. 2022 Nov 12;47(4):932-.
9. Waseem I, Hussain MN, Siddique F, Nawaz U, Azeem A. Effectiveness of Low-level Laser Therapy for Treatment of Cervical Pain in Patients with Trigger Points of Upper Trapezius: Low-level Laser therapy for Trigger Points of Trapezius. The Healer Journal of Physiotherapy and Rehabilitation Sciences. 2023 Jul 7;3(6):552-9.
10. Waseem I, Tanveer F, Fatima A. Can the addition of low level laser therapy to conventional physical therapy be beneficial for management of pain and cervical range of motion in patients with trigger point of upper trapezius? Anaesth Pain & Intensive Care 2019;23(2):64-68. DOI: https://doi.org/10.35975/apic.v24i1.1228
11. Hussain Z, Waseem I, Azeem A. Prevalence of myofascial trigger points due to postural stressors among digital product users. Pioneer Journal of Biostatistics and Medical Research. 2023;1(3):29-34.
12. Kashif M, Anwar M, Noor H, Iram H, Hassan HMJ. Prevalence of Musculoskeletal Complaints of Arm, Neck and Shoulder and Associated Risk Factors in Computer Office Workers. Physikalische Medizin, Rehabilitationsmedizin, Kurortmedizin. 2020 Oct;30(5):299–305.
13. Moustafa IM, Shousha TM, Walton LM, Raigangar V, Harrison DE. Reduction of Thoracic Hyper-Kyphosis Improves Short and Long Term Outcomes in Patients with Chronic Nonspecific Neck Pain: A Randomized Controlled Trial. Journal of Clinical Medicine. 2022 Jan;11(20):6028.
14. Kazeminasab S, Nejadghaderi SA, Amiri P, Pourfathi H, Araj-Khodaei M, Sullman MJM, et al. Neck pain: global epidemiology, trends and risk factors. BMC Musculoskeletal Disorders. 2022 Jan 3;23(1):26.
15. Mahmood T, Afzal MW, Waseem I, Arif MA, Mahmood W. Comparative effectiveness of routine physical therapy with and without instrument assisted soft tissue mobilization for improving pain and disability in patients with neck pain due to upper crossed syndrome. Annals of Punjab Medical College. 2022 Mar

31;16(1):45-50
16. Erdem EU, Ünver B, Akbas E, Kinikli GI. Immediate effects of thoracic manipulation on cervical joint position sense in individuals with mechanical neck pain: A randomized controlled trial. Journal of Back and Musculoskeletal Rehabilitation. 2021 Jan 1;34(5):735–43.
17. Abbaszadeh-Amirdehi M, Mirasi S, Salehi H, Olyaei G. Effectiveness of Thoracic Manipulation on the Treatment of Patients With Mechanical Non-Specific Neck Pain. Journal of Modern Rehabilitation. 2016;10(4):145–54.
18. Tsegay GS, Gebregergs GB, Weleslassie GG, Hailemariam TT. Effectiveness of Thoracic Spine Manipulation on the Management of Neck Pain: A Systematic Review and Meta-Analysis of Randomized Control Trials. Journal of Pain Research. 2023 Dec 31;16:597–609.
19. Kim DH, Kim SY. Comparison of immediate effects of sling-based manual therapy on specific spine levels in subjects with neck pain and forward head posture: a randomized clinical trial. Disability and Rehabilitation. 2020 Sep 10;42(19):2735–42.
20. Liu J, Feng W, Zhou J, Huang F, Long L, Wang Y, et al. Effects of sling exercise therapy on balance, mobility, activities of daily living, quality of life and shoulder pain in stroke patients: a randomized controlled trial. European Journal of Integrative Medicine. 2020 Apr 1;35:101077.
21. Lin KY, Tsai YJ, Hsu PY, Tsai CS, Kuo YL. Effects of Sling Exercise for Neck Pain: A Systematic Review and Meta-Analysis. Physical Therapy. 2021 Aug 1;101(8):pzab120.
22. Park GW, An J, Kim SW, Lee BH. Effects of Sling-Based Thoracic Active Exercise on Pain and Function and Quality of Life in Female Patients with Neck Pain: A Randomized Controlled Trial. Healthcare. 2021 Nov;9(11):1514.
23. Mahmoudabadi Z, Hadadnezhad M, Mimar R, Hamoongard M. The Impacts of Neck Stabilization and Thoracic Mobility Exercises on Disability, Range of Motion, and Endurance of Females with Non-Specific Chronic Neck Pain: A Clinical Trial Study. Journal of Gorgan University of Medical Sciences. 2024;26(1):25–36.
24. Seo J, Song C, Shin D. A single-center study comparing the effects of thoracic spine manipulation vs mobility exercises in 26 office workers with chronic neck pain: A randomized controlled clinical study. Medical science monitor: International Medical Journal of Experimental and Clinical Research. 2022;28:e937316-1.
25. Joshi S, Balthillaya G, Neelapala YVR. Immediate effects of cervicothoracic junction mobilization versus thoracic manipulation on the range of motion and pain in mechanical neck pain with cervicothoracic junction dysfunction: a pilot randomized controlled trial. Chiropr Man Therap. 2020 Dec;28(1):38.
26. Saddique M, Bhutto MA, Jahangir S, Pt AS, Shafiq MS, Zafar I, et al. Effectiveness of Thoracic Manipulation and Cervicothoracic Mobilisation in Decreasing Pain and Increasing Rom in Nonspecific Neck Pain. Pakistan Journal of Medical & Health Sciences. 2022;16(12):592–592.