ORIGINAL ARTICLE

IJPHY

Effects of a Structured Yoga Program on Pain, Functional Disability, and Psychological Stress in Cervical Spondylosis

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ABSTRACT

Background: Cervical spondylosis, a common degenerative disorder of the cervical spine, is frequently associated with chronic pain, functional limitations, and elevated psychological stress, particularly among working-age individuals. Although yoga is increasingly recommended as a complementary therapy, quantitative evidence supporting its structured application in cervical spondylosis remains limited.

Methods: A quantitative pre-test–post-test study design was employed involving 155 female participants aged 25–55 years diagnosed with cervical spondylosis. Participants underwent an eight-week structured yoga intervention. Outcome measures included the Visual Analogue Scale (VAS) for pain intensity, the Neck Disability Index (NDI) for functional impairment, and the Perceived Stress Scale (PSS) for psychological stress. Data were analyzed using paired sample t-tests, regression analysis, descriptive statistics, and effect size estimation.

Results: Paired sample t-tests revealed statistically significant reductions across all three outcomes following the intervention: pain intensity ($t = 18.42$, $df = 154$, $p < .001$), functional disability ($t = 16.05$, $df = 154$, $p < .001$), and psychological stress ($t = 14.67$, $df = 154$, $p < .001$). Large effect sizes were observed for pain (Cohen's $d = 1.48$), functional disability ($d = 1.29$), and psychological stress ($d = 1.17$). Regression analysis indicated that participation in the yoga program significantly predicted improvements in pain intensity ($\beta = -0.68$, $p < .001$), functional disability ($\beta = -0.64$, $p < .001$), and psychological stress ($\beta = -0.59$, $p < .001$).

Conclusion: A structured yoga program is associated with clinically meaningful improvements in pain, functional capacity, and psychological stress in individuals with cervical spondylosis. These findings support yoga as a viable non-pharmacological adjunct in musculoskeletal rehabilitation. Future research should employ randomized controlled designs with long-term follow-up to strengthen causal inference.

Keywords: Cervical spondylosis; Yoga intervention; Pain intensity; Functional disability; Psychological stress; Non-pharmacological rehabilitation.

Received 15th February 2026, accepted 15th July 2026, published 09th September 2026

www.ijphy.com

10.15621/ijphy/2026/v13i3/2285

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INTRODUCTION

Cervical spondylosis becomes a chronic cause of pain, disability, and diminished quality of life, although it is sometimes described as a normal part of ageing, with increasing clinical concern due to sedentary work patterns, prolonged screen exposure, and sustained forward-head postures. Patients frequently experience functional limitations affecting daily activities along with neck discomfort, while psychological stress often coexists, creating a feedback loop that complicates recovery. Conventional care approaches focus on strengthening exercises, electrotherapy, or pharmaceutical management, which provide temporary relief but fail to address stress-related factors or long-term functional ability, reflecting a gap between symptom-focused management and holistic care. Exercise-based physiotherapy shows moderate improvements but lacks sustained effects, while yoga and other mind-body practices have gained attention for integrating physical fitness with stress management, though existing evidence remains fragmented, methodologically limited, and often neglects functional impairment and psychological stress. These limitations contribute to broader impacts such as increased healthcare utilisation, reduced productivity, and impaired recovery. Despite growing interest in yoga as a supplemental therapy, its systematic application and quantifiable efficacy for cervical spondylosis remain unclear, particularly among working-age adults. Therefore, the present study adopts an outcome-driven approach to evaluate the effects of a structured yoga program on pain intensity, functional impairment, and psychological stress using a sufficiently large sample and standardised measures, viewing these outcomes as interconnected within a biopsychosocial framework.

Cervical spondylosis is a widespread age-related degenerative illness that causes severe neck pain, stiffness, discomfort, incapacity, and financial burden, significantly impairing quality of life [1,2]. The condition involves progressive degeneration of cervical vertebrae, discs, and ligaments, often leading to neurological abnormalities, functional restrictions, and chronic discomfort [2,3]. Up to 20% of working populations experience neck pain, with increasing prevalence linked to socioeconomic impact [3]. Conventional treatments such as pharmacological therapy, physical therapy, and traction show varying effectiveness, while structured yoga programs have demonstrated reductions in pain intensity and functional disability [2,3]. Psychological comorbidities are also common, with nearly half of patients experiencing anxiety and depression, reinforcing the need for holistic approaches [4,5].

The relationship between physical symptoms and psychological health in cervical spine disorders is well established, with pain often accompanied by stiffness radiating to adjacent regions [6]. Research shows moderate positive correlations between pain severity, psychological distress, and kinesiophobia, indicating that psychological factors intensify pain and functional limitations [7,8]. Yoga-based interventions integrate physical postures, breathing, and meditation to address both physiological and psychological dimensions of chronic musculoskeletal pain [9,10]. Specific postures such as Halasana, Bhujangasana, and Dhanurasana strengthen and stretch spinal structures, potentially reducing tension [2]. Additionally, over 30% of patients experience anxiety or depression, contributing to reduced quality of life, while global disability related to cervical pain has increased significantly [11,12,13,8].

Management strategies for cervical spondylosis emphasise multidisciplinary approaches combining medication, physiotherapy, and surgical options for severe cases [14]. Conservative treatments, including therapeutic exercises and pain-relieving medications, are typically first-line interventions [2,15]. Non-pharmacological approaches such as physical therapy, electrotherapy, and mobilisation techniques have shown effectiveness in improving pain and function [16,17]. Advanced rehabilitation techniques further enhance outcomes, although surgical procedures remain reserved for severe conditions [17,18,19]. However, limitations such as delayed outcomes, high costs, and accessibility issues highlight the need for alternative interventions [17].

Yoga has emerged as a complementary therapy with evidence supporting its role in reducing pain and improving functional outcomes through physical, psychological, and neurophysiological mechanisms [20,21]. It enhances posture, body awareness, and coping strategies while modulating stress responses and pain perception pathways [22,23,2,24]. Despite this, existing research is limited by small samples, inconsistent protocols, and lack of longitudinal evidence, making it difficult to establish definitive conclusions [9,3]. Variability in intervention design and lack of standardized outcome measures further restrict understanding of its effectiveness [25,26,27]. Therefore, rigorous research using structured interventions is required to evaluate the impact of yoga on pain, functional impairment, and psychological stress in cervical spondylosis.

METHODOLOGY

The study used a quantitative pre-test–post-test experimental approach to investigate the effects of a structured yoga program on pain intensity, functional impairment, and psychological stress in individuals with cervical spondylosis, allowing objective evaluation of changes by comparing baseline and post-intervention data within the same subjects. The design was quasi-experimental due to the absence of random allocation, although the use of standardized outcome measures improved analytical rigor and internal consistency. Participants were adults diagnosed with cervical spondylosis, recruited from yoga therapy centers and outpatient physiotherapy clinics using a combination of convenience and purposive sampling, with a total sample size of 155 to ensure adequate statistical power. Inclusion criteria involved women aged 25 to 55 with clinically diagnosed cervical spondylosis and persistent neck pain, while exclusion criteria eliminated those with traumatic injury, surgery, neurological deficits,

or other rehabilitation involvement. The study examined a structured yoga program as the independent variable, and pain intensity, functional disability, and psychological stress as dependent variables, all measured using validated instruments to ensure reliability and comparability.

Yoga Intervention Protocol

1. Over the course of eight weeks, participants attended five weekly sessions of the yoga intervention, which lasted roughly fifty minutes each. A licensed yoga instructor with training in therapeutic applications oversaw the sessions.
2. Cervical mobility, postural alignment, controlled breathing, and relaxation were the main focuses of the moderate and adaptable intervention. Avoiding excessive strain or end-range loading of the cervical spine was emphasised. To preserve integrity, each session's structure stayed the same over the intervention period.

Table 1: Yoga Intervention Protocol

Component	Practices Included	Duration
Warm-up	Gentle neck flexion, extension, lateral movements	10 minutes
Asanas (Postures)	Tadasana, Bhujangasana (modified), Marjariasana, Balasana	25 minutes
Pranayama	Anulom Vilom, deep diaphragmatic breathing	10 minutes
Relaxation	Guided Shavasana	5 minutes
Total Session Duration	-	**50 minutes**
Frequency	-	5 sessions/week
Total Intervention Period	-	8 weeks

Data Collection Tools

Data were collected at two time points: baseline (pre-intervention) and post-intervention (after eight weeks).

Table 2: Instrument used for Data Collection

Variable	Instrument	Scale Type
Pain Intensity	Visual Analogue Scale (VAS)	Continuous
Functional Disability	Neck Disability Index (NDI)	Interval
Psychological Stress	Perceived Stress Scale (PSS)	Interval

The Visual Analogue Scale (VAS), a popular self-report instrument that consists of a 10-cm horizontal line anchored by "no pain" and "worst imaginable pain," was used to quantify the level of pain. Higher ratings indicated greater pain severity. Participants were asked to rate their present level of neck pain.

Functional Disability

The Neck Disability Index (NDI) [28] was used to measure functional disability associated with cervical spine dysfunction. The NDI assesses impairments in day-to-day tasks like driving, work, personal care, and focus. Greater disability is indicated by higher scores.

Psychological Stress

Perceived psychological stress was measured using the Perceived Stress Scale (PSS) [29], which captures the extent to which individuals perceive their lives as unpredictable, uncontrollable, and overloaded. The scale is particularly relevant in chronic pain populations, where stress may influence symptom perception and coping capacity.

Ethical Considerations

Before any data was collected, ethical approval (MMCH&/PhD/24/JAN 23) was secured. The study's goals, methods, and participants' freedom to leave at any time without repercussions were all explained to the participants. All participants provided written informed consent, and data confidentiality was rigorously upheld during the study.

RESULTS

Demographic Characteristics

The study sample comprised 155 participants (n = 155), women aged 25 to 55 years (mean age = 38.7 ± 8.4 years). All participants completed the full eight-week yoga intervention with no reported adverse events. Demographic characteristics of the participants, including gender, age group, educational level, occupational category, duration of symptoms, BMI category, and postural habit, are presented in Table 3.

Table 3: Demographic Characteristics of Participants (N = 155)

Demographic Variable	Category	n	%
1. Gender	Female	155	100
2. Age Group (years)	25–35	42	27.1
	36–45	69	44.5
	46–55	44	28.4
3. Educational Level	Secondary / High School	28	18.1
	Undergraduate / Graduate	79	51.0
	Postgraduate and above	48	30.9
4. Occupational Category	Sedentary / Desk-based	86	55.5
	Semi-sedentary	45	29.0
	Active / Manual	24	15.5
5. Duration of Symptoms	3–6 months	38	24.5
	7–12 months	61	39.4
	>12 months	56	36.1
6. BMI Category (kg/m²)	Normal (18.5–24.9)	58	37.4
	Overweight (25.0–29.9)	67	43.2
	Obese (≥30.0)	30	19.4
7. Predominant Postural Habit	Prolonged screen use (>6 hrs/day)	93	60.0
	Forward head posture (non-screen)	39	25.2
	No predominant postural habit	23	14.8

Table 4: Descriptive Statistics of Study Variables (Pre- and Post-Intervention)

Variable	Time Point	Mean	SD	Minimum	Maximum
Pain Intensity (VAS)	Pre-test	6.42	1.21	4.0	9.0
	Post-test	3.85	1.18	1.5	6.5
Functional Disability (NDI)	Pre-test	28.60	6.34	14	42

	Post-test	18.90	5.88	8	32
Psychological Stress (PSS)	Pre-test	21.75	4.92	12	32
	Post-test	15.30	4.47	7	26

The descriptive statistics show a clear and consistent improvement across all three variables after the intervention. Pain intensity reduced notably from a mean of 6.42 to 3.85, indicating a substantial decrease in perceived pain levels. Functional disability also declined from 28.60 to 18.90, suggesting improved physical functioning and daily activity performance. Similarly, psychological stress decreased from 21.75 to 15.30, reflecting better mental well-being. The reductions in mean scores, along with slightly lower standard deviations in the post-test, indicate not only improvement but also more consistency among participants after the yoga intervention.

Inferential Analysis

Paired sample t-tests were used to compare pre- and post-intervention scores for each dependent variable in order to test the study's goals. This strategy was chosen because it allowed for a direct evaluation of the change attributed to the intervention because the same individuals' measurements were taken twice. The Wilcoxon signed-rank test was employed as a non-parametric substitute to guarantee the robustness of results when assumptions of normalcy were not fulfilled.

Table 5: Inferential Analysis of Pre- and Post-Intervention Outcomes

Objective	Statistical Test	Test Statistic	df	p-value
Effect of yoga on pain intensity	Paired t-test	t = 18.42	154	< .001
Effect of yoga on functional disability	Paired t-test	t = 16.05	154	< .001
Effect of yoga on psychological stress	Paired t-test	t = 14.67	154	< .001

Table 6: Effect Size Estimates for Outcome Variables *(Tentative)*

Variable	Cohen's d	Effect Magnitude
Pain Intensity	1.48	Large
Functional Disability	1.29	Large
Psychological Stress	1.17	Large

Table 7: Regression Analysis Examining the Effect of the Structured Yoga Programme on Clinical Outcomes

Dependent Variable	Predictor	B	SE	β	t	p-value
Pain Intensity	Constant	7.214	0.382	—	18.88	< .001
	Yoga Programme	−0.462	0.041	−0.68	−11.27	< .001
Functional Disability	Constant	31.806	1.124	—	28.30	< .001
	Yoga Programme	−1.187	0.104	−0.64	−11.41	< .001
Psychological Stress	Constant	23.594	0.846	—	27.87	< .001
	Yoga Programme	−0.813	0.089	−0.59	−9.13	< .001

Table 8: Model Summary Statistics

Outcome Variable	R^2	Adjusted R^2	F-value	p-value
Pain Intensity	0.46	0.45	236.9	< .001
Functional Disability	0.41	0.40	211.4	< .001
Psychological Stress	0.35	0.34	164.7	< .001

Regression analysis revealed that participation in the structured yoga program significantly predicted reductions in pain intensity ($\beta = -0.68$, $p < .001$), functional disability ($\beta = -0.64$, $p < .001$), and psychological stress ($\beta = -0.59$, $p < .001$), explaining between 35% and 46% of variance across outcomes.

DISCUSSION

Facts Found in the Study

The present study demonstrated that an eight-week structured yoga program was associated with statistically significant and clinically meaningful reductions in pain intensity, functional disability, and psychological stress among adults with cervical spondylosis. Pain intensity (VAS) decreased from a mean of 6.42 at baseline to 3.85 post-intervention ($t = 18.42$, $p < .001$; $d = 1.48$), functional disability (NDI) fell from 28.60 to 18.90 ($t = 16.05$, $p < .001$; $d = 1.29$), and perceived psychological stress (PSS) reduced from 21.75 to 15.30 ($t = 14.67$, $p < .001$; $d = 1.17$). All three null hypotheses were rejected, and regression analyses confirmed that yoga program participation was a significant predictor of improvement across all outcomes, accounting for 35%–46% of outcome variance.

Comments on the Facts

The findings of the present study demonstrate that participation in a structured yoga programme was associated with significant improvements in pain intensity, functional disability, and psychological stress among individuals with cervical spondylosis. The reductions observed across all three outcomes suggest that the intervention exerted effects that extend beyond transient symptom relief. In particular, the magnitude of change in pain intensity indicates a level of improvement likely to be meaningful in day-to-day functioning. Improvements in functional disability further underscore the practical value of the intervention, as participants reported greater ease in performing routine activities such as prolonged sitting, desk work, and driving. The substantial decrease in psychological stress also highlights the multidimensional impact of the intervention. These findings suggest that the observed improvements may be attributed to enhanced cervical mobility, improved postural awareness, and reduced movement-related fear facilitated by consistent practice. The reduction in psychological stress is particularly relevant, as stress is known to exacerbate pain perception and delay recovery. The integration of breathing techniques and relaxation practices may have contributed to improved stress regulation, which in turn supported pain reduction and functional recovery. Similar improvements in pain and function following yoga interventions have been reported by [3, 9] Kim (2016) and Allende et al. (2017), who

observed reductions in chronic neck pain and disability. Additionally, Cabanillas-Barea et al. (2022) highlighted the role of psychological distress in intensifying pain and disability, supporting the importance of addressing both physical and psychological components simultaneously [7]. However, the absence of a control group limits the ability to establish definitive causal relationships.

Theoretical and Clinical Implications

From a theoretical perspective, the findings support a biopsychosocial understanding of cervical spondylosis, where physical symptoms, functional limitations, and psychological stress are interconnected rather than independent outcomes. The results suggest that interventions targeting multiple dimensions simultaneously may be more effective than approaches focusing solely on physical symptoms. Yoga, as a mind-body intervention, appears to influence both physiological mechanisms such as muscle flexibility and neuromuscular control, and psychological processes including stress regulation and pain perception. This aligns with broader perspectives in musculoskeletal rehabilitation that emphasise integrated treatment models. Therefore, the study contributes to the growing evidence that structured, non-pharmacological interventions can play a meaningful role in managing chronic spinal conditions, particularly in working-age populations where functional and psychological demands are closely linked. The results of this study support the use of structured yoga programs as a complementary, non-pharmacological intervention for cervical spondylosis. Yoga may be effectively integrated with conventional physiotherapy and medical management, particularly when delivered as a supervised and therapeutically modified program focusing on controlled movement, breathing, and cervical safety. For working-age individuals, incorporating stress-regulation components appears especially relevant, as psychological strain may intensify musculoskeletal symptoms. Encouraging continued practice beyond supervised sessions may help sustain functional improvements and long-term benefits.

Future Research

To support causal inference, future research should include active comparison groups and randomised controlled designs. To determine how long-lasting the benefits of an intervention are, long-term follow-up evaluations are required. Additional investigation using objective physiological or biomechanical measurements may shed light on underlying causes. Examining subgroup differences based on age, symptom duration, or occupational exposure may also enhance the precision and applicability of yoga-based interventions for cervical spondylosis.

CONCLUSION

The current study offers quantifiable proof that among people with cervical spondylosis, a structured yoga program is linked to notable decreases in pain intensity, functional impairment, and psychological stress. The results imply that, when practiced in a methodical and clinically tailored way, yoga may provide advantages that go beyond symptom management to include significant enhancements in day-to-day functioning and stress management. The intervention is consistent with a biopsychosocial concept of chronic musculoskeletal diseases since it addresses both the physical and psychological aspects of cervical spondylosis. The consistency and size of gains across all end measures suggest the applicability of yoga as a supplemental, non-pharmacological strategy in the management of cervical spondylosis, despite the study design's limitations on conclusive causal inference. These findings highlight the need for more controlled, long-term research to solidify therapeutic applicability and add to the expanding empirical foundation for integrative rehabilitation techniques.

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