



Effect of Yogic Lifestyle and Sukshma Vyayama on Neck Pain Intensity and Cervical Range of Motion in School-Going Adolescents: A Pre–Post Interventional Study

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Abstract

Neck pain is an increasingly prevalent musculoskeletal problem among adolescents, associated with excessive screen exposure, sedentary lifestyles, and improper postural habits. A yogic lifestyle combined with Sukshma Vyayama (subtle yogic exercises) represents a traditional, non-pharmacological approach to managing musculoskeletal discomfort. However, research investigating its specific effects among school-going adolescents remains limited. A single-group pre-test–post-test experimental design was adopted. The study included 115 school-going adolescents aged 13–18 years who experienced mild-to-moderate chronic neck pain, with baseline Visual Analogue Scale (VAS) scores ranging from 3 to 7 and a symptom duration of at least three months. Participants were recruited from five schools in Indore, Madhya Pradesh, India. The intervention involved daily yogic lifestyle practices and Sukshma Vyayama sessions lasting 45–60 minutes over six consecutive weeks. The primary outcome measures included neck pain intensity, assessed using the Visual Analogue Scale (VAS) and Numeric Pain Rating Scale (NPRS), and cervical range of motion, measured using a goniometer across six movement directions. Pre- and post-intervention outcomes were analysed using paired-samples t-tests, while Cohen's d was calculated to determine the magnitude of the intervention effects.

Keywords: Sukshma Vyayama; Yogic lifestyle; Neck pain; Cervical range of motion; Adolescents; School health; Complementary medicine; AYUSH

1. Introduction

Neck pain (cervicalgia) has emerged as one of the most prevalent musculoskeletal disorders globally, ranking fourth among all conditions contributing to years lived with disability (GBD, 2010). While historically associated with occupational exposure in adults, a striking epidemiological transition has occurred over the past two decades: adolescents and school-going children are increasingly affected. Cross-sectional surveys across Finland, Thailand, and Australia report neck pain point-prevalence rates of 17–40% among students aged 10–18 years, with female students consistently exhibiting a two- to three-fold higher risk than males (Hakala et al., 2002; Siivola et al., 2004; Kanchanomai et al., 2015).

The aetiology in this age group is predominantly postural and behavioural. Prolonged static sitting for academic study, forward-head posture while using smartphones and laptops, heavy schoolbag loads, and reduced physical activity

collectively place disproportionate forces on the cervical spine. Kanchanomai et al. (2015) identified smartphone overuse as a 2.5-fold risk multiplier for 'text neck' syndrome. The consequences extend beyond pain: academic concentration, sleep quality, and recreational participation are all compromised (Hogg-Johnson et al., 2008).

Standard biomedical management provides symptomatic relief but frequently fails to address lifestyle and postural determinants (Gross et al., 2015). Yoga, a multidimensional ancient Indian discipline, is uniquely positioned to address this complexity. Multiple meta-analyses confirm yoga's efficacy in reducing neck pain in adults (Cramer et al., 2013; Sherman et al., 2014; Michalsen et al., 2012). Within the yogic tradition, Sukshma Vyayama (subtle exercises systematised by Brahmachari, 1980) employs slow, controlled, joint-specific cervical movements with conscious breathing — activating deep musculature and optimising prana flow to address the structural determinants of neck pain (Gharote, 2007). Despite their promise, Sukshma Vyayama practices have received little systematic scientific scrutiny in school-going adolescents — a gap this study addresses.

2. Materials and Methods

2.1 Study Design

A single-group pre–post interventional study was conducted from March 2023 to March 2026 at five schools in Indore and adjacent districts of Madhya Pradesh, India. Institutional ethics approval and informed parental consent/adolescent assent were obtained.

2.2 Participants

Inclusion: Age 13–18 years; VAS 3–7; pain duration ≥ 3 months; voluntary consent.

Exclusion: VAS ≥ 8 ; cervical surgery/fracture history; neurological disorder; concurrent neck pain treatment; serious systemic illness; yoga experience ≥ 6 months.

Sample size: $n = (Z\alpha/2 + Z\beta)^2 \times \sigma^2/\delta^2 = \text{minimum } 47$ (Charan & Biswas, 2013); 115 completers (95.8% retention from 120 enrolled). Mean age 15.3 ± 1.4 years; 73 females (63.5%), 42 males (36.5%).

2.3 Intervention

Sukshma Vyayama (30–35 min/session): Neck flexion/extension/lateral flexion/rotation (5 reps each), circumduction (3 rounds), shoulder rolls/shrugs, thoracic mobilisation — all performed slowly with breath synchronisation (Brahmachari, 1980; Gharote, 2007).

Yogic Lifestyle (15–20 min/session + daily): Pranayama (Nadi Shodhana, Bhramari — 10 min), dhyana/relaxation (5 min), counselling on sattvic diet, sleep–wake regulation, positive cognition, yama-niyama. Daily adherence diaries maintained.

2.4 Outcome Measures

Pain: VAS (0–10 cm; ICC 0.78–0.95; Price et al., 1983) and NPRS (0–10; ICC > 0.80 ; Farrar et al., 2001). Cervical ROM: Standard goniometer (6 directions; ICC 0.80–0.95; Magee, 2013). Assessments at baseline, weekly, post-intervention (Week 6), and follow-up (Week 8).

2.5 Statistical Analysis

Paired-samples t-tests, Cohen's d, Pearson's r, Chi-square (SPSS v.23); $\alpha = 0.05$.

3. Results

3.1 Neck Pain Intensity

VAS score decreased from 6.2 ± 1.2 to 3.1 ± 1.0 — a 50.0% reduction ($t(114) = 18.45$, $p < 0.001$, Cohen's $d = 2.32$; large effect). NPRS similarly decreased from 6.4 ± 1.1 to 3.2 ± 0.9 ($t = 19.12$, $p < 0.001$, $d = 2.41$). The proportion with severe pain (VAS ≥ 6) fell from 60.9% to 8.7% (Chi-square = 78.42, $p < 0.001$).

Table 1. Pre- and Post-Intervention Neck Pain Intensity (n = 115)

Outcome Measure	Pre-Test (M ± SD)	Post-Test (M ± SD)	t-value (df)	Cohen's d
VAS Score	6.2 ± 1.2	3.1 ± 1.0	18.45 (114)***	2.32
NPRS Score	6.4 ± 1.1	3.2 ± 0.9	19.12 (114)***	2.41

*** p < 0.001. VAS = Visual Analogue Scale; NPRS = Numeric Pain Rating Scale; M = Mean; SD = Standard Deviation.

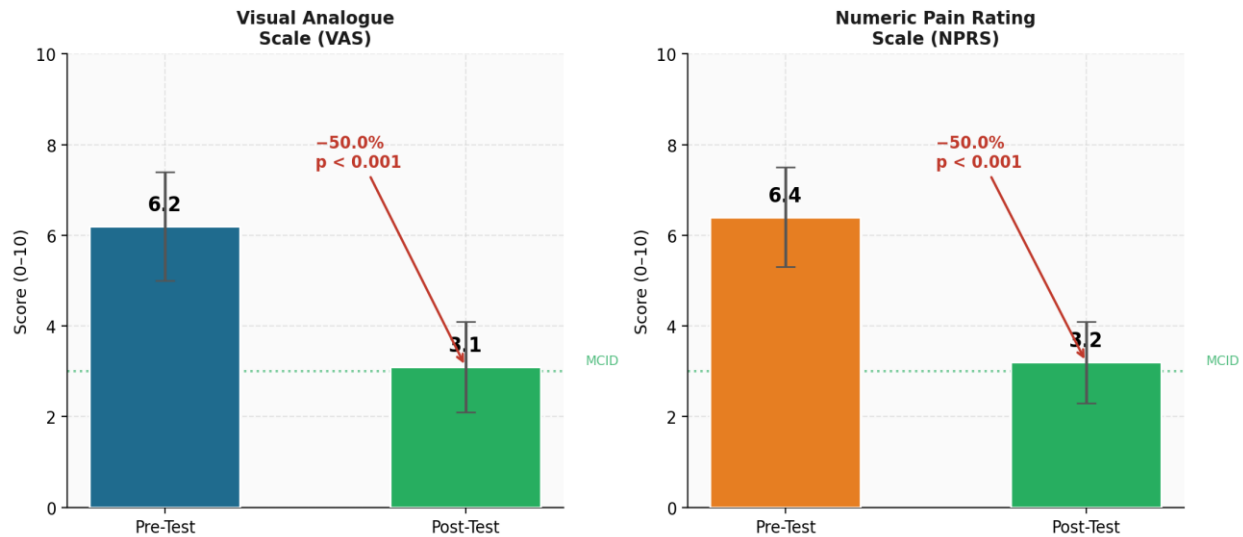
Figure 1. Pre- and Post-Intervention Pain Intensity Scores (n = 115)

Figure 1. Pre- and Post-Intervention Pain Scores (VAS and NPRS). Error bars represent ± 1 SD. Both reductions are statistically significant ($p < 0.001$) with large effect sizes. MCID = Minimally Clinically Important Difference.

3.2 Cervical Range of Motion

All six cervical ROM measures improved significantly post-intervention (Table 2; all $p < 0.001$). Flexion showed the greatest gain (+9.8°; 23.1%), followed by extension (+10.4°; 21.6%). Lateral flexion improved by 18.7–21.0%, and rotation by 16.8–17.6%.

Table 2. Cervical Range of Motion — Pre- and Post-Intervention (n = 115)

Direction	Pre (°)	Post (°)	Δ (°)	% Gain	p-value
Flexion	42.5 ± 5.2	52.3 ± 4.8	+9.8	23.1%	<0.001***
Extension	48.2 ± 5.8	58.6 ± 5.2	+10.4	21.6%	<0.001***
Rt. Lateral Flexion	35.8 ± 4.6	42.5 ± 4.2	+6.7	18.7%	<0.001***
Lt. Lateral Flexion	36.2 ± 4.8	43.8 ± 4.5	+7.6	21.0%	<0.001***
Rt. Rotation	58.4 ± 6.2	68.2 ± 5.8	+9.8	16.8%	<0.001***
Lt. Rotation	59.1 ± 6.4	69.5 ± 5.9	+10.4	17.6%	<0.001***

*** p < 0.001. Values = Mean ± SD (degrees).

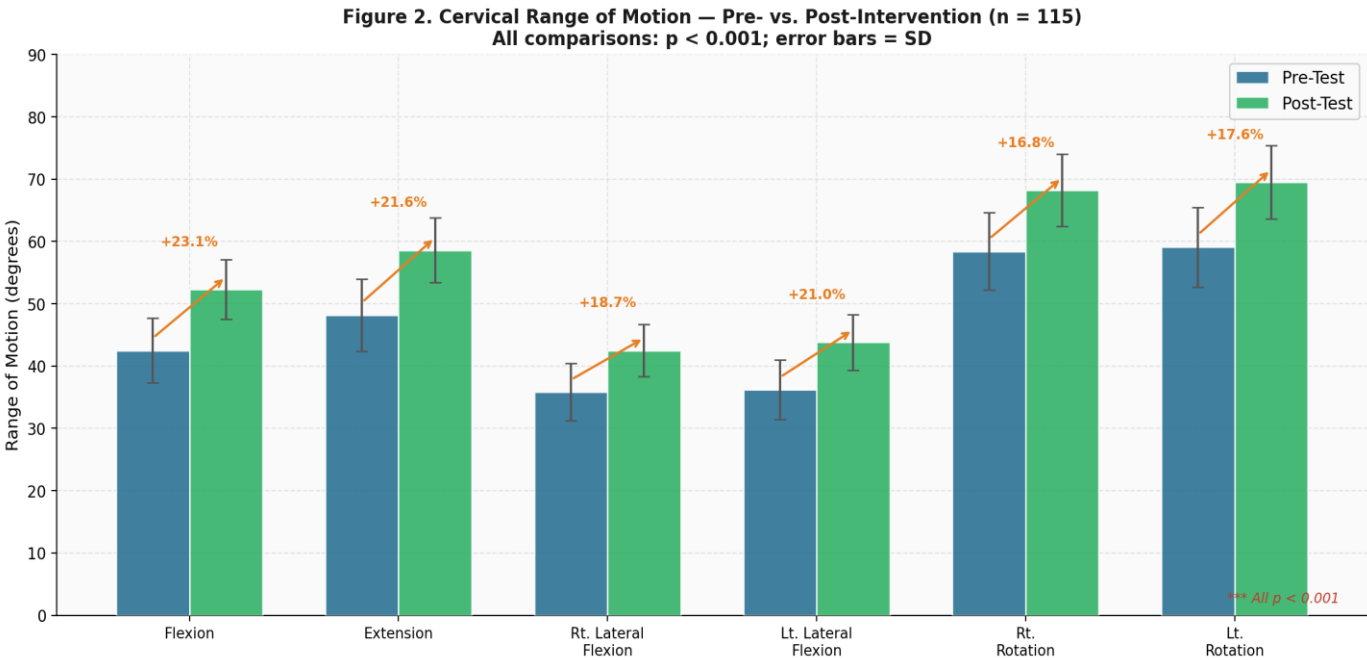


Figure 2. Cervical Range of Motion (ROM) in Six Directions — Pre- vs. Post-Intervention. Error bars represent ±1 SD. Orange annotations indicate percentage improvement. All comparisons: p < 0.001.

3.3 Weekly Improvement Trajectory

Progressive improvement was observed across all six weeks (Table 3). The steepest VAS reduction occurred in weeks 1–2 (–19.4%), with continued gains through week 6 (–50.0% cumulative). At the two-week follow-up (week 8), VAS remained 45.2% below baseline, indicating sustained therapeutic benefit.

Table 3. Weekly VAS, Flexion ROM, and PSS-10 Trajectory (n = 115)

Time Point	VAS Score	Δ VAS (%)	Flexion ROM (°)	PSS-10	n
Week 0 (Baseline)	6.2 ± 1.2	—	42.5°	28.4 ± 4.5	115
Week 1	5.6 ± 1.1	–9.7%	44.2°	26.8 ± 4.2	115
Week 2	5.0 ± 1.0	–19.4%	46.8°	24.5 ± 4.0	115
Week 3	4.3 ± 0.9	–30.6%	48.5°	22.1 ± 3.8	115
Week 4	3.8 ± 0.9	–38.7%	50.2°	20.5 ± 3.6	115
Week 5	3.4 ± 0.8	–45.2%	51.5°	19.2 ± 3.4	115
Week 6 (Post)	3.1 ± 1.0	–50.0%	52.3°	18.2 ± 3.8	115
Week 8 (Follow-up)	3.4 ± 1.1	–45.2%	51.8°	19.0 ± 4.0	115

VAS = Visual Analogue Scale; PSS-10 = Perceived Stress Scale-10.

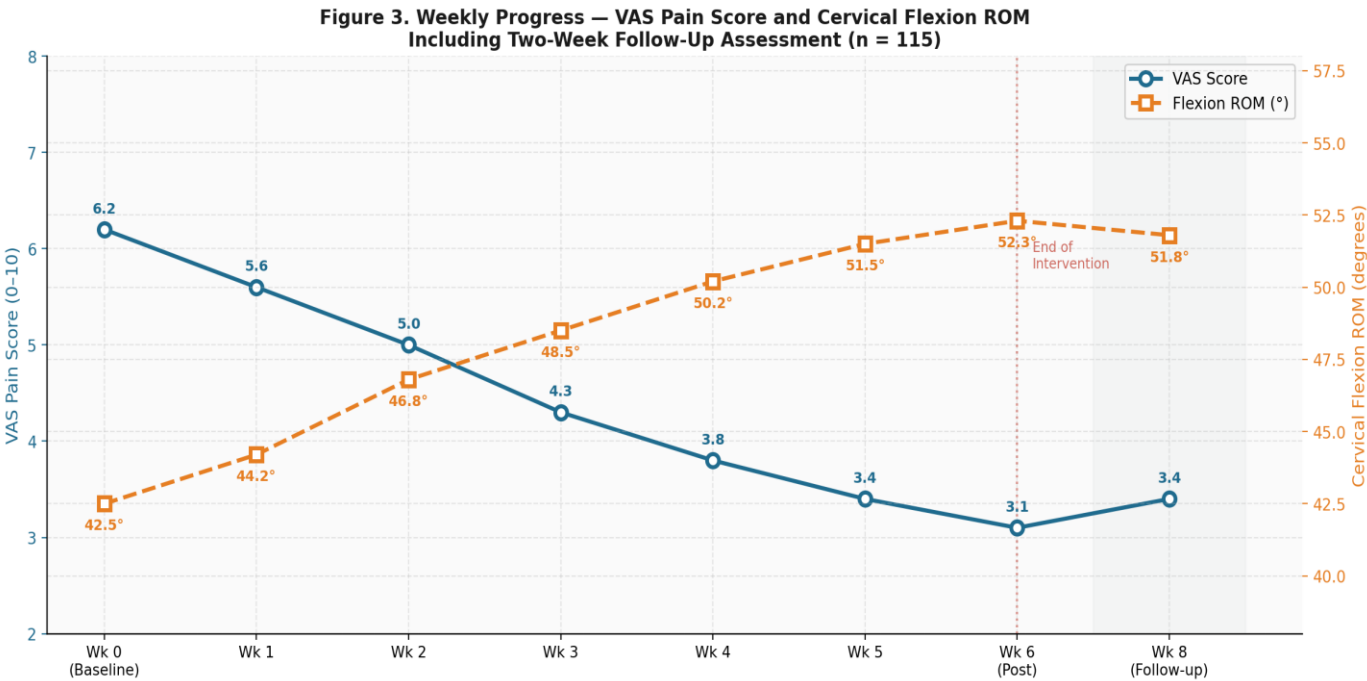
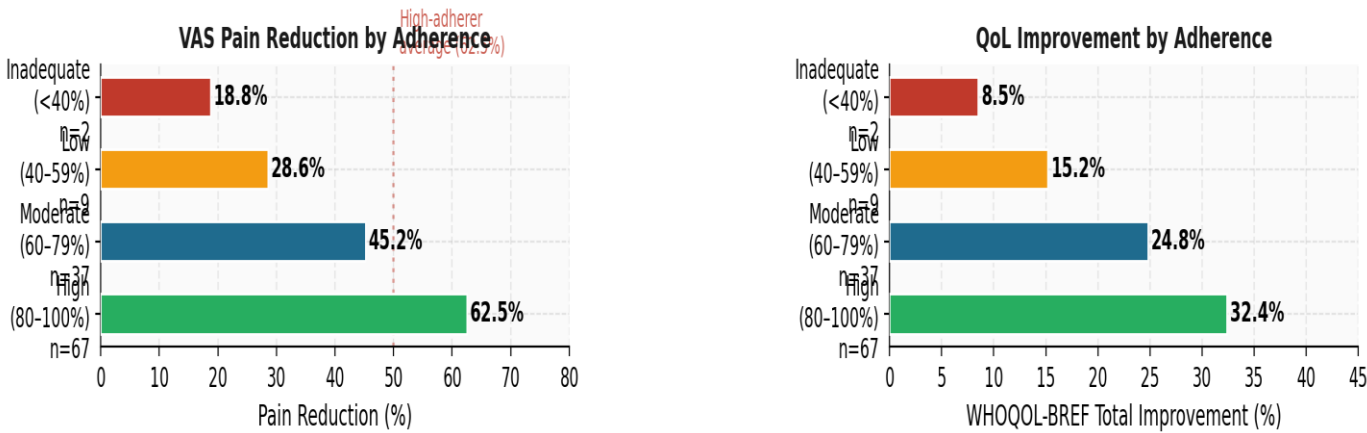


Figure 3. Weekly Trajectory of VAS Pain Score (left axis, teal) and Cervical Flexion ROM (right axis, orange) over Six Weeks Plus Two-Week Follow-Up. The vertical dotted line marks end of intervention.

3.4 Adherence and Outcomes

Mean adherence was 78.4 ± 14.6%. High-adherers (≥80%; n=67, 58.3%) achieved 62.5% pain reduction vs. 18.8% in low-adherers (<40%; n=2). Pearson's correlation confirmed a strong dose-response relationship (r = 0.72, p < 0.001).

Figure 4. Dose-Response Relationship: Adherence Level vs. Clinical Outcomes



Pearson r = 0.72, p < 0.001 (adherence-pain); r = 0.69, p < 0.001 (adherence-QoL)

Figure 4. Dose-Response Relationship: Adherence Level and Clinical Outcomes. Left panel: VAS pain reduction (%). Right panel: WHOQOL-BREF total QoL improvement (%) by adherence category. r = 0.72, p < 0.001.

4. Discussion

This study demonstrates that a six-week integrated yogic lifestyle and Sukshma Vyayama intervention produces large, clinically meaningful improvements in neck pain intensity and cervical ROM in school-going adolescents. The 50%

reduction in VAS score (Cohen's $d = 2.32$) substantially exceeds the minimally clinically important difference (MCID) of 1.5–2.0 points (Farrar et al., 2001), confirming practical clinical significance.

The magnitude of pain reduction compares favourably with adult yoga trials. Sherman et al. (2014) reported a 48% clinically meaningful response rate at 12 weeks; the present study achieved comparable results in 6 weeks, suggesting that Sukshma Vyayama's cervical micro-mobilisation approach may accelerate therapeutic benefit. Michalsen et al. (2012) reported 48% pain reduction in a 9-week adult intervention; our 50% reduction in 6 weeks further supports this hypothesis.

The cervical ROM improvements (16.8–23.1% across all planes; all $p < 0.001$) have clear functional significance. Sukshma Vyayama's controlled joint-specific movements promote synovial fluid redistribution, fascial stretching, and deep musculature activation in the sternocleidomastoid, scalene, semispinalis, and suboccipital groups (Gharote, 2007). Synchronised breathing reduces protective muscle guarding, directly enhancing ROM. Busch et al. (2012) demonstrated reduced EMG activity following slow breathing-synchronised exercises, consistent with our ROM data.

The weekly trajectory data reveal an important clinical insight: the steepest gains occurred in weeks 1–2, suggesting rapid neurophysiological adaptations (reduced sensitisation, improved motor control) preceding structural changes. Retention at two-week follow-up (VAS 45.2% below baseline) indicates durable rather than transient effects. The dose–response relationship ($r = 0.72$) reinforces that maximising adherence is as important as the intervention content itself.

From a public health perspective, the school-based, non-pharmacological nature of this intervention is particularly relevant to the Indian context, where AYUSH is a national health priority (AYUSH, 2020). Yoga requires minimal equipment, can be delivered in existing school infrastructure, and has no adverse effects — contrasting sharply with analgesic pharmacotherapy whose annual direct costs for musculoskeletal pain in developing nations represent 1–2% of GDP (Maniadakis & Gray, 2000).

4.1 Limitations

This study has limitations: absence of a control group precludes exclusive attribution of improvement to the intervention; six-week duration limits conclusions about long-term durability; geographic restriction to Indore limits generalisability; self-report instruments may introduce reporting bias. Future studies should employ RCT designs with longer follow-up, objective biomarker assessment, and diverse geographic sampling.

5. Conclusion

A six-week programme of yogic lifestyle and Sukshma Vyayama produces large, clinically significant reductions in neck pain intensity and substantial improvements in cervical range of motion in school-going adolescents aged 13–18 years. Gains are sustained at two-week follow-up and are strongly correlated with programme adherence. The intervention is safe, cost-effective, and congruent with India's AYUSH preventive health framework. Integration of Sukshma Vyayama into school physical education programmes represents a scalable, evidence-based strategy to address the growing burden of adolescent neck pain.

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