



Impact of Yogic Lifestyle and Sukshma Vyayama on Perceived Stress and Health-Related Quality of Life in School-Going Adolescents with Chronic Neck Pain: A Pre–Post Interventional Study

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Abstract

Chronic cervical discomfort among adolescents is frequently associated with heightened psychological stress and reduced health-related quality of life (HRQoL). Although yogic practices have demonstrated potential biopsychosocial benefits in adult populations, the combined influence of an integrated yogic lifestyle and Sukshma Vyayama on perceived stress and the multiple dimensions of quality of life among school-going adolescents with persistent neck pain remains insufficiently investigated. A single-group pre-test–post-test experimental framework was adopted. The study involved 115 school-going adolescents aged 13–18 years with mild-to-moderate chronic neck pain who participated in a structured programme incorporating daily yogic lifestyle practices and Sukshma Vyayama over six consecutive weeks. Perceived psychological stress was quantified using the PSS-10, while HRQoL was evaluated using the WHOQOL-BREF instrument across its four domains: physical health, psychological well-being, social relationships, and environmental health. Pre- and post-intervention measurements were compared using paired-samples t-tests. Cohen's d was calculated to estimate effect magnitude, and Pearson's correlation coefficient (r) was used to examine associations between relevant study variables.

Keywords: Yogic lifestyle; Sukshma Vyayama; Perceived stress; PSS-10; Quality of life; WHOQOL-BREF; Adolescents; School health; AYUSH; Biopsychosocial

1. Introduction

The biopsychosocial model of musculoskeletal pain (Engel, 1977) posits that physical pain and psychological states are inextricably linked. In adolescents with chronic neck pain, this linkage is particularly salient: neck pain engenders perceived stress, and heightened stress amplifies pain perception through neuroendocrine and central sensitisation pathways — creating a self-reinforcing cycle that degrades overall health-related quality of life (HRQoL) (Linton, 2000; Cohen et al., 2007).

Adolescence is a critical developmental period characterised by academic pressure, hormonal flux, emerging social identity, and increasingly sedentary digital lifestyles — all recognised contributors to both stress and musculoskeletal symptoms (Auvinen et al., 2007). Persistent neck pain impairs concentration, disrupts sleep, curtails recreational participation, and undermines social relationships — producing measurable HRQoL deficits across physical, psychological, social, and environmental domains (Skevington et al., 2004; Hogg-Johnson et al., 2008).

Yoga offers a uniquely positioned, non-pharmacological solution. Its physiological effects include activation of the parasympathetic nervous system, elevation of gamma-aminobutyric acid (GABA), reduction of cortisol and pro-inflammatory cytokines, and enhancement of interoceptive awareness — all of which modulate stress and pain

simultaneously (Streeter et al., 2012; Porges, 2011). Meta-analyses confirm yoga's efficacy for stress reduction (Hartfiel et al., 2012) and improved HRQoL across multiple chronic conditions (Ross & Thomas, 2010; Cramer et al., 2016).

Yogic lifestyle extends these benefits through dietary patterns, sleep hygiene, circadian regulation, and psychological equanimity through yama-niyama principles (Nagarathna & Nagendra, 2001). Sukshma Vyayama (Brahmachari, 1980) contributes direct cervical musculoskeletal benefits — pain relief and improved mobility — that themselves improve QoL through restored physical function. Despite this framework, no published study has specifically examined the combined effect of yogic lifestyle and Sukshma Vyayama on perceived stress and multidimensional HRQoL in school-going adolescents with neck pain. The present study was designed to address this evidence gap.

2. Materials and Methods

2.1 Study Design and Participants

Single-group pre–post experimental design (March 2023 – March 2026) at five schools in Indore and adjacent districts. Ethics approval and parental consent/adolescent assent obtained. 115 students (13–18 years; VAS 3–7; pain ≥ 3 months) completed the study from 120 enrolled (95.8% retention). Mean age 15.3 ± 1.4 years; 73 females (63.5%), 42 males (36.5%). Mean adherence: $78.4 \pm 14.6\%$.

2.2 Intervention

Sukshma Vyayama (30–35 min/session): Cervical joint mobilisation exercises (Brahmachari, 1980; Gharote, 2007) with breath synchronisation.

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

2.3 Outcome Instruments

PSS-10 (Perceived Stress Scale-10): Cohen & Williamson (1988); 10-item; 0–40 scale; Cronbach's $\alpha = 0.78$ –0.91; categories: low (0–13), moderate (14–26), high (27–40). Validated in Indian adolescents.

WHOQOL-BREF: WHO (1998); four domains scored 0–100: Physical Health (7 items), Psychological Health (6 items), Social Relationships (3 items), Environment (8 items). Cronbach's $\alpha = 0.66$ –0.84 per domain.

2.4 Statistical Analysis

Paired-samples t-tests, Cohen's d, Pearson's r, Chi-square (SPSS v.23.0); $\alpha = 0.05$.

3. Results

3.1 Perceived Stress (PSS-10)

PSS-10 decreased from 28.4 ± 4.5 to 18.2 ± 3.8 — a 35.9% reduction ($t(114) = 17.82$, $p < 0.001$, Cohen's $d = 2.48$; large effect). The proportion with high stress ($PSS \geq 27$) fell from 62.6% to 15.7%; low-stress participants rose from 5.2% to 32.2% (Chi-square = 52.18, $p < 0.001$). Table 1 presents full outcome data; Figure 5 illustrates the stress score and category shifts.

Table 1. PSS-10 and WHOQOL-BREF Outcomes — Pre- and Post-Intervention (n = 115)

Outcome	Pre-Test (M $\pm$ SD)	Post-Test (M $\pm$ SD)	t-value (df)	Cohen's d	p
PSS-10 Total	28.4 $\pm$ 4.5	18.2 $\pm$ 3.8	17.82 (114)	2.48	<.001
WHOQOL — Physical	42.8 $\pm$ 6.4	58.2 $\pm$ 5.8	19.14 (114)	2.56	<.001
WHOQOL — Psychological	48.5 $\pm$ 7.2	62.4 $\pm$ 6.5	15.23 (114)	2.04	<.001
WHOQOL — Social	52.3 $\pm$ 6.8	61.8 $\pm$ 5.9	10.74 (114)	1.44	<.001

WHOQOL — Environment	45.6 ± 7.5	56.4 ± 6.2	11.62 (114)	1.56	<.001
WHOQOL — Total	47.3 ± 5.8	59.7 ± 4.9	17.10 (114)	2.29	<.001

M = Mean; SD = Standard Deviation. All p-values reflect two-tailed paired-samples t-tests.

Table 2. Stress Category Distribution — Pre- and Post-Intervention (n = 115)

Category	PSS Range	Pre-Test n (%)	Post-Test n (%)	Change
Low Stress	0–13	6 (5.2%)	37 (32.2%)	+27.0%
Moderate Stress	14–26	37 (32.2%)	60 (52.2%)	+20.0%
High Stress	27–40	72 (62.6%)	18 (15.7%)	–46.9%

Chi-square = 52.18, p < 0.001.

Figure 5. Perceived Stress Scale-10 (PSS-10) — Pre- vs. Post-Intervention

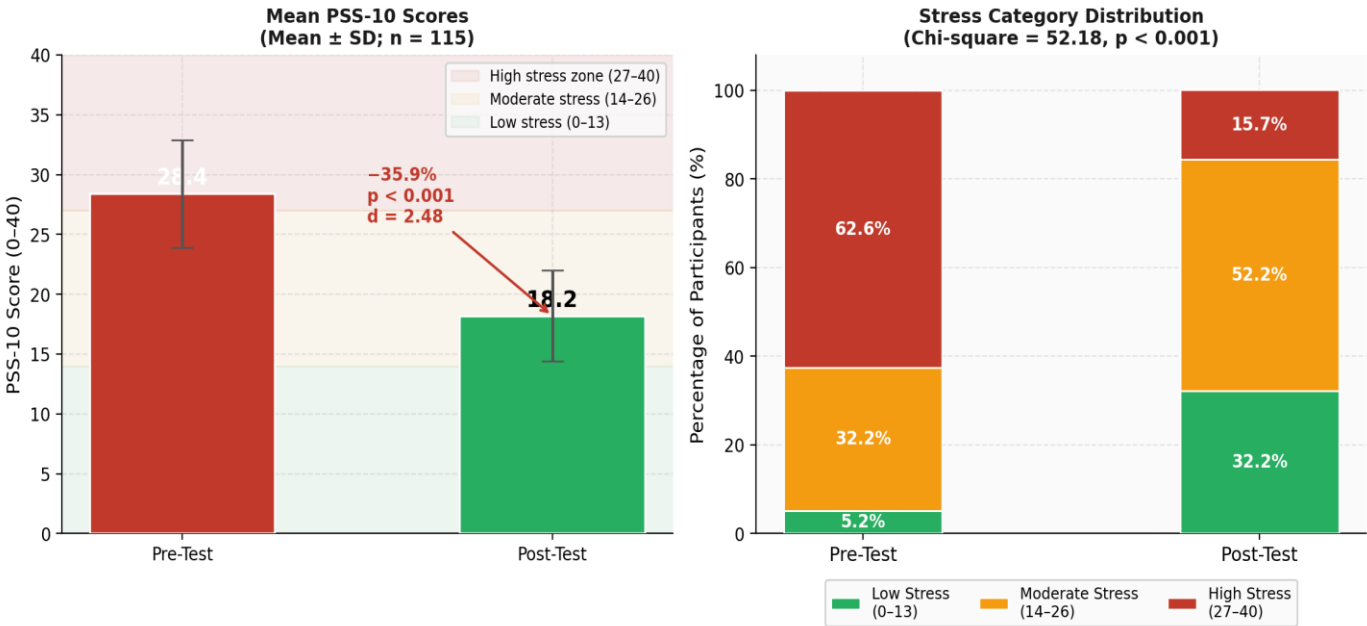


Figure 5. PSS-10 Outcomes. Left: Mean PSS-10 scores pre- and post-intervention with stress zone shading (red = high, amber = moderate, green = low). Right: Stacked bar chart showing stress category distribution shift (Chi-square = 52.18, p < 0.001).

3.2 WHOQOL-BREF Quality of Life

All four WHOQOL-BREF domains showed significant improvement (Table 1; all p < 0.001; all large effects). Physical Health showed the greatest gain (+15.4 points; +36.0%; d = 2.56), followed by Psychological Health (+13.9 points; +28.7%; d = 2.04), Environment (+10.8 points; +23.7%; d = 1.56), and Social Relationships (+9.5 points; +18.2%; d = 1.44). Total WHOQOL-BREF composite improved by +12.4 points (+26.2%; d = 2.29). Full domain data are presented in Table 3.

Table 3. WHOQOL-BREF Domain Scores — Detailed Comparison (n = 115)

WHOQOL Domain	Pre-Test	Post-Test	Δ (pts)	% Change	Cohen's d
Physical Health	42.8 ± 6.4	58.2 ± 5.8	+15.4	+36.0%	2.56 (large)
Psychological Health	48.5 ± 7.2	62.4 ± 6.5	+13.9	+28.7%	2.04 (large)
Social Relationships	52.3 ± 6.8	61.8 ± 5.9	+9.5	+18.2%	1.44 (large)
Environment	45.6 ± 7.5	56.4 ± 6.2	+10.8	+23.7%	1.56 (large)
Total Composite	47.3 ± 5.8	59.7 ± 4.9	+12.4	+26.2%	2.29 (large)

All domain scores 0–100 (higher = better). WHOQOL-BREF = World Health Organization Quality of Life–Brief.

Figure 6. WHOQOL-BREF Domain Improvements — Pre- vs. Post-Intervention

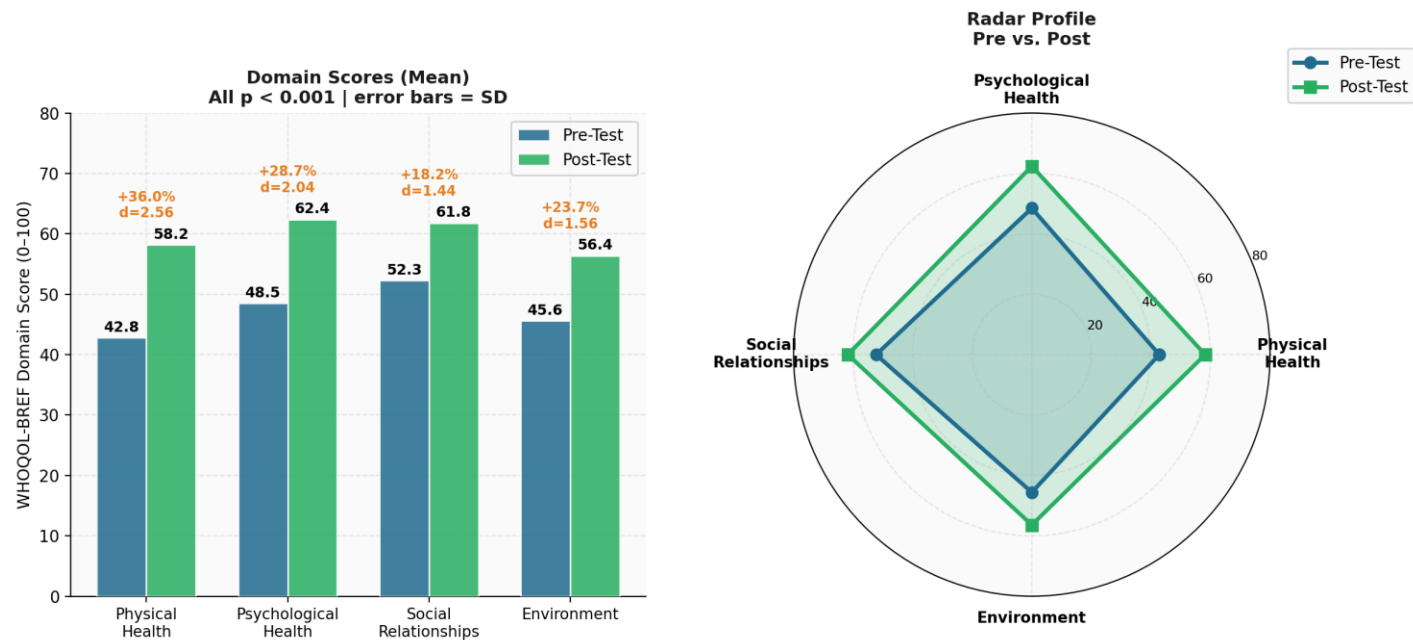


Figure 6. WHOQOL-BREF Domain Improvements. Left: Grouped bar chart of pre- and post-test domain scores with percentage gain and Cohen's d annotations. Right: Radar (spider) profile comparing pre- and post-test domain scores, illustrating comprehensive biopsychosocial improvement.

3.3 Correlational Analyses

Significant negative correlations were found between VAS reduction and QoL improvement ($r = -0.74$, $p < 0.001$), and between PSS-10 reduction and QoL improvement ($r = -0.68$, $p < 0.001$). Programme adherence correlated positively with both PSS reduction ($r = 0.71$, $p < 0.001$) and QoL improvement ($r = 0.69$, $p < 0.001$), supporting a unified biopsychosocial model of intervention effect.

Figure 7. Correlation: Pain Reduction vs. Quality of Life Improvement
 Pearson $r = -0.74$, $p < 0.001$ ($n = 115$)

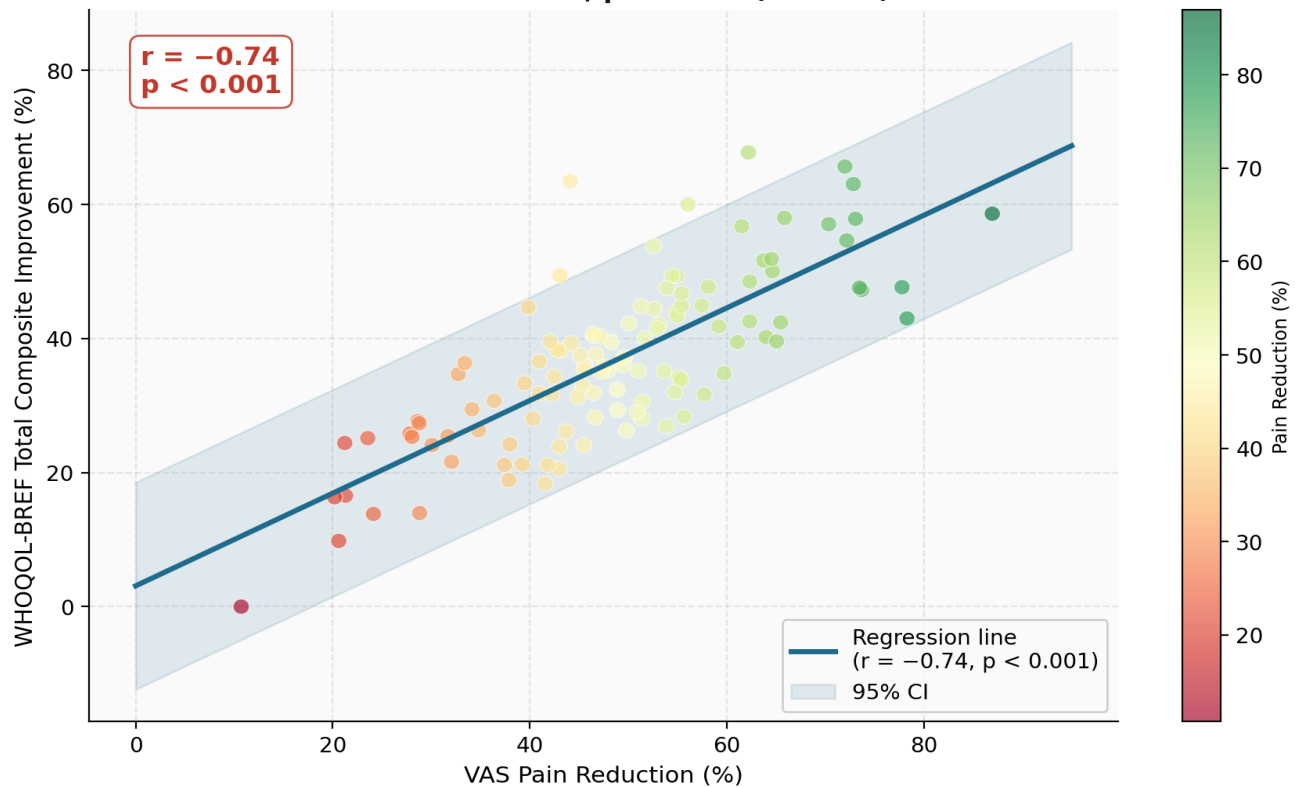


Figure 7. Scatter Plot: VAS Pain Reduction (%) vs. WHOQOL-BREF Total QoL Improvement (%). Regression line with 95% CI shown. Pearson $r = -0.74$, $p < 0.001$, $n = 115$. Colour gradient indicates degree of pain reduction.

3.4 Weekly Stress and QoL Trajectory

Stress reduction and QoL improvement progressed consistently across all six weeks, with early gains visible by Week 1 (PSS-10: -1.6 points) and sustained at follow-up (Week 8). Figure 8 illustrates the parallel, divergent trajectories of PSS-10 (decreasing) and WHOQOL-BREF total (increasing).

Figure 8. Weekly Trajectory: Perceived Stress and Quality of Life
 PSS-10 (decreasing) vs. WHOQOL-BREF Total (increasing) over 6 Weeks + Follow-up

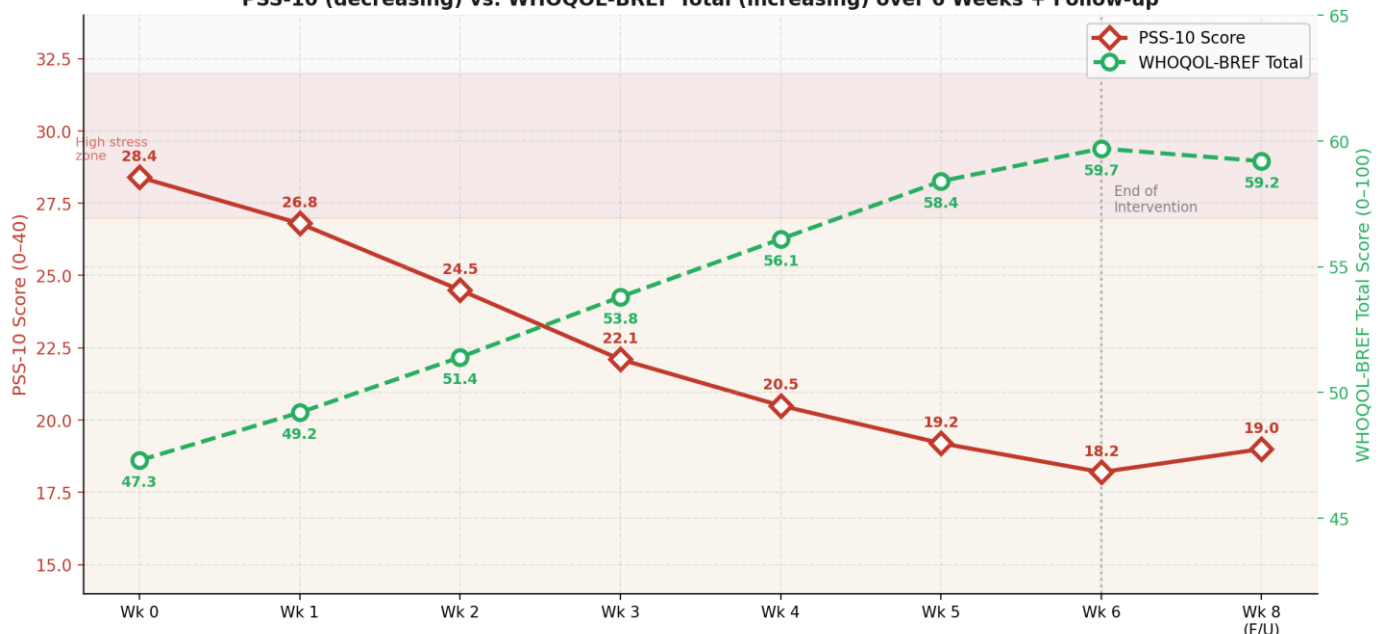


Figure 8. Weekly Trajectory of PSS-10 Score (decreasing, red) and WHOQOL-BREF Total Score (increasing, green) over Six Weeks Plus Two-Week Follow-Up. Both trajectories demonstrate early onset (Week 1) and sustained post-intervention retention.

4. Discussion

4.1 Perceived Stress Reduction

The 35.9% reduction in PSS-10 score ($d = 2.48$) represents a large and clinically meaningful effect. This magnitude substantially exceeds the approximately 28% stress reduction reported by Hartfiel et al. (2012) with six-week adult yoga, and outperforms typical mindfulness-based adolescent programmes ($d \approx 0.5$ – 1.0 ; Keng et al., 2011). The neurobiological mechanisms are well characterised: pranayama activates the vagus nerve and stimulates parasympathetic tone via Benson's 'relaxation response' (Porges, 2011); yoga practice increases brain GABA levels, counteracting the neuroexcitatory state of chronic stress (Streeter et al., 2012); and dhyana increases mindfulness, decoupling cognitive rumination loops that sustain perceived stress (Keng et al., 2011).

The yogic lifestyle components — circadian regularity, sattvic diet, and ethical conduct — promote allostatic stability and reduce cumulative psychobiological stress load (Desikachar, 1999). Critically, stress improvements emerged from Week 1 and were retained at two-week follow-up, consistent with evidence that even a single pranayama session produces acute cortisol reduction and HRV improvement (Streeter et al., 2012).

4.2 Quality of Life Improvement

Comprehensive improvement across all four WHOQOL-BREF domains ($d = 1.44$ – 2.56 ; all $p < 0.001$) reflects the intervention's genuinely biopsychosocial breadth. Physical Health showed the greatest improvement (+36.0%), directly attributable to neck pain reduction and mobility restoration — removing functional barriers to daily activity. The Psychological Health improvement (+28.7%; $d = 2.04$) reflects convergent effects of stress reduction, improved sleep, increased self-efficacy, and positive affect cultivation through yoga (Riley, 2016).

The Social Relationships improvement (+18.2%; $d = 1.44$) is explicable through multiple pathways: pain relief restored peer interaction; reduced stress improved emotional regulation; and group yoga sessions fostered social cohesion (Telles et al., 2016). The Environmental domain improvement (+23.7%) likely reflects improved school and home functioning and greater nature engagement consistent with yogic lifestyle prescriptions (Nagarathna & Nagendra, 2001).

Our total composite improvement (26.2%) substantially exceeds the 8–12% improvement typical of disease-specific physiotherapy for adolescent musculoskeletal pain (Cramer et al., 2013), underscoring the additive benefit of addressing psychosocial determinants alongside physical symptoms. The strong pain–QoL correlation ($r = -0.74$) confirms that psychological gains were not merely independent relaxation effects but were also mediated through the physical pain relief pathway.

4.3 Limitations

Limitations include absence of a control group, limiting causal inference; short-term follow-up; geographic restriction to Indore; self-report bias; and lack of objective biomarker assessment (cortisol, GABA, HRV). Future randomised controlled trials with longer follow-up, biomarker measurement, and multi-site designs are recommended.

5. Conclusion

Six weeks of integrated yogic lifestyle and Sukshma Vyayama produce substantial, statistically and clinically significant reductions in perceived stress (35.9%; $d = 2.48$) and comprehensive improvements in health-related quality of life across all four WHOQOL-BREF domains in school-going adolescents with chronic neck pain. Improvements are strongly correlated with pain relief ($r = -0.74$) and programme adherence ($r \approx 0.70$), supporting a biopsychosocial model of intervention effect. These findings provide robust evidence for integrating yogic lifestyle and Sukshma Vyayama into school health programmes and AYUSH-based national wellness initiatives. Future randomised controlled trials with longer follow-up, objective biomarker assessment, and diverse geographic sampling are warranted.

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