



**International Journal of Biology, Pharmacy
and Allied Sciences (IJBPAS)**

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

EFFECT OF MINDFUL BREATHING PRACTICES ON UPPER TRAPEZIUS MUSCLE TENDERNESS IN COLLEGE STUDENTS EXPERIENCING EXAM-RELATED STRESS

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Received 12th Nov. 2025; Revised 18th Dec. 2025; Accepted 8th April 2026; Available online 1st Sept. 2026

<https://doi.org/10.31032/IJBPAS/2026/15.9.10486>

ABSTRACT

Background:

Academic stress during examination periods is a common cause of both psychological distress and physical discomfort, particularly in the neck and shoulder regions. The upper trapezius muscle is frequently implicated due to increased muscle tone associated with stress-related sympathetic activation. Mindful breathing has emerged as a cost-effective, non-pharmacological intervention for stress management. However, limited research exists evaluating its effect on muscle tenderness. This study aimed to investigate the effect of a 2-week mindful breathing practice on upper trapezius muscle tenderness and perceived stress levels in college students experiencing exam-related stress.

Methodology:

A quasi-experimental pre-post design was used. Thirty physiotherapy students (aged 18–25 years) scheduled to appear for exams and meeting inclusion criteria—PSS-10 score ≥ 14 and trapezius tenderness $\geq 3/10$ —were recruited. Participants practiced guided mindful breathing for 10 minutes daily, 5 days per week, over two weeks. The intervention focused on nasal breathing and body awareness. Outcome measures included upper trapezius muscle tenderness (palpation-based 0–10 scale, ICC = 0.75–0.89) and perceived stress using the PSS-10 questionnaire (ICC = 0.78–0.91).

Results:

There was a significant reduction in muscle tenderness (Pre: 5.47 ± 0.80 ; Post: 2.93 ± 0.69 ; $p < 0.001$, Cohen's $d \approx 4.9$) and perceived stress (Pre: 26.43 ± 2.23 ; Post: 17.96 ± 2.16 ; $p < 0.001$, Cohen's $d \approx 10.9$).

Conclusion:

A brief mindful breathing intervention significantly reduced both psychological stress and muscle tenderness in physiotherapy students during exam stress. These findings support mindful breathing as an effective, accessible strategy for addressing both mental and musculoskeletal effects of academic stress.

Keywords: Mindful breathing, Upper trapezius, Academic stress, Muscle tenderness, PSS-10, Physiotherapy students

INTRODUCTION

Academic stress is a prevalent concern among university students, particularly during examination periods, and has been associated with various psychological and somatic complaints. High levels of stress have been shown to activate the hypothalamic–pituitary–adrenal (HPA) axis and sympathetic nervous system, leading to increased muscle tone, especially in areas like the neck and shoulders [1, 2]. This stress-related muscle activation frequently manifests as tenderness and discomfort in the upper trapezius, which is a common clinical complaint among students and office workers [3].

Stress-induced musculoskeletal tension, particularly in the cervical region, has been documented in multiple studies linking emotional distress to increased muscle activity and pain perception [4, 5]. Specifically, electromyographic studies have revealed heightened activity in the upper trapezius muscle during mental tasks

and stressful conditions, which may explain why students under exam stress often report neck tightness and pain [6]. Prolonged static postures during study sessions and screen time further exacerbate this muscular tension [7].

Mindfulness practices, particularly mindful breathing, have garnered attention as effective, low-cost interventions for stress management [8]. Mindful breathing involves focused attention on the breath while cultivating awareness and non-judgmental acceptance of present-moment experiences. Numerous studies have shown that mindfulness techniques can modulate autonomic activity, reduce cortisol levels, and alleviate subjective stress [9, 10]. This intervention has been successfully employed in various populations, including students, healthcare workers, and patients with chronic pain [11].

While mindfulness is well-established for reducing psychological stress, fewer studies

have explored its impact on physical manifestations of stress, such as muscle tenderness. Some preliminary research suggests that mindfulness-based stress reduction (MBSR) may reduce myofascial pain and muscle hyperactivity [12, 13]. However, the relationship between mindful breathing and specific muscle tenderness, such as in the upper trapezius, remains under-researched, especially in student populations during periods of academic pressure.

This study aims to bridge this gap by evaluating the effect of a 2-week mindful breathing intervention on upper trapezius muscle tenderness and perceived stress levels in physiotherapy students undergoing exam stress. The hypothesis was that daily guided mindful breathing would result in a significant reduction in both subjective stress and muscle tenderness.

MATERIALS AND METHODS

Study Design: Quasi-experimental (pre-post design).

Participants: 30 physiotherapy students aged 18–25.

INCLUSION

- Be aged between 18–25 years
- Be undergraduate or postgraduate physiotherapy students
- Be scheduled to appear in academic exams within the study timeline

- Have self-reported stress score ≥ 14 on PSS-10 (indicating moderate stress)
- Have palpable tenderness ($\geq 3/10$) in the upper trapezius region on baseline examination
- Be willing to perform daily breathing practice
- Have no prior formal mindfulness/meditation training

EXCLUSION

- Have a current or past diagnosis of psychiatric or neurological disorders
- Are undergoing manual therapy, massage, or physiotherapy for neck/shoulder conditions
- Are on analgesics, anti-inflammatory, psychotropic, or muscle relaxant medications
- Have a history of cervical spine injury, disc prolapse, or whiplash injury
- Are pregnant (due to hormonal stress modulation)
- Are involved in structured physical training, yoga, or breathing-based interventions during the study period
- Have skin conditions, infections, or wounds over the trapezius region

INTERVENTION

- Daily 10-minute guided mindful breathing.
- Duration: 2 weeks (5 days/week).

- Focus: Slow, nasal breathing and body awareness.

OUTCOME MEASURE

- Trapezius Tenderness: Palpation (0–10 scale), ICC = 0.75–0.89.
- Perceived Stress: PSS-10, ICC = 0.78–0.91.

PROCEDURE

The study was conducted after obtaining ethical clearance from the Institutional Ethics Committee. Recruitment was carried out via announcements in classrooms and digital platforms of the physiotherapy department. Students aged 18–25 years who were scheduled to appear in academic examinations within the study period were invited to participate. A total of 30 participants meeting the inclusion and exclusion criteria were enrolled after obtaining informed written consent.

Participants were screened using the Perceived Stress Scale (PSS-10). Those scoring ≥ 14 , indicating moderate to high stress, were considered eligible. Additionally, palpation of the upper trapezius muscle was conducted to identify tenderness rated $\geq 3/10$ on the numeric rating scale (NRS). Basic demographic data were collected.

Intervention Protocol

Participants were instructed to perform guided mindful breathing exercises for 10 minutes per day, 5 days per week, for 2 consecutive weeks.

- The breathing practice involved slow nasal breathing with focused attention on the breath and body awareness, performed in a seated position.
- A standardized audio recording of the guided mindfulness script was provided to each participant to ensure uniformity.
- Adherence was monitored using a daily self-report log maintained by the participants.

Post-Intervention Assessment

After the 2-week intervention period:

- Trapezius muscle tenderness was re-assessed using palpation on the same side and same point as baseline.
- The PSS-10 questionnaire was re-administered to evaluate changes in perceived stress.

All assessments were conducted by the same examiner to ensure reliability.

Statistical Analysis

1. Upper Trapezius Muscle Tenderness

- Pre-intervention Mean $\pm$ SD: 5.47 ± 0.80
- Post-intervention Mean $\pm$ SD: 2.93 ± 0.69
- Mean Difference: 2.54
- $t(29) = 26.93$, $p < 0.001$
- Effect Size (Cohen's d) ≈ 4.9 (*very large*)

Interpretation: There was a statistically significant reduction in upper trapezius muscle tenderness after the 2-week mindful breathing intervention.

2. Perceived Stress Scale (PSS-10)

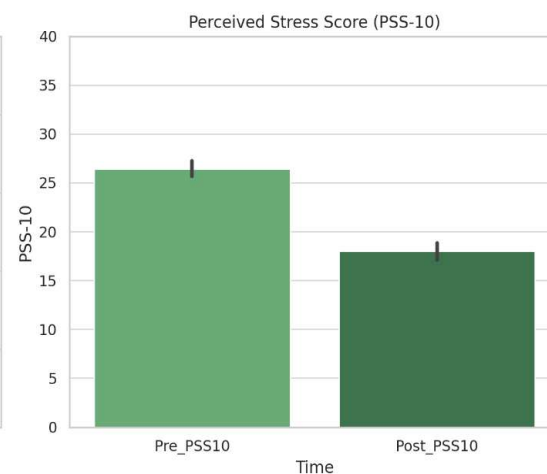
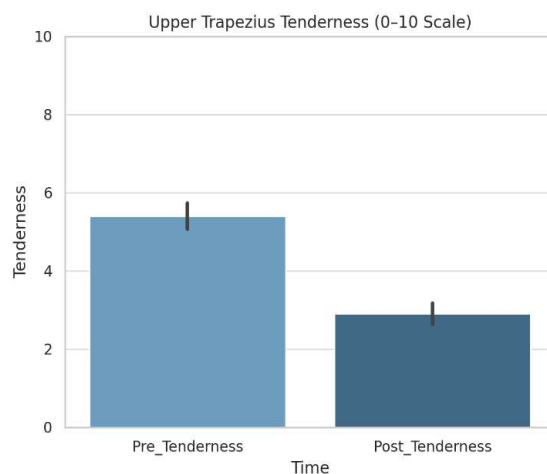
- Pre-intervention Mean $\pm$ SD: 26.43 $\pm$ 2.23
- Post-intervention Mean $\pm$ SD: 17.96 $\pm$ 2.16

- Mean Difference: 8.47
- $t(29) = 59.69, p < 0.001$
- Effect Size (Cohen's d) ≈ 10.9 (*very large*)

Interpretation: There was a highly significant decrease in perceived stress scores after practicing mindful breathing.

RESULTS:

Outcome Measure	Pre-Mean $\pm$ SD	Post-Mean $\pm$ SD
Tenderness (0–10)	5.47 $\pm$ 0.80	2.93 $\pm$ 0.69
PSS-10 (0–40)	26.43 $\pm$ 2.23	17.96 $\pm$ 2.16



A total of 30 physiotherapy students (aged 18–25 years) participated in the study. Following a 2-week mindful breathing intervention, there was a significant reduction in upper trapezius muscle tenderness, with the mean score decreasing from 5.47 ± 0.80 to 2.93 ± 0.69 on a 0–10 numeric palpation scale ($t(29) = 26.93, p < 0.001$).

Similarly, participants demonstrated a significant reduction in perceived stress levels, as measured by the PSS-10, with scores reducing from 26.43 ± 2.23 to 17.96 ± 2.16 ($t(29) = 59.69, p < 0.001$). The effect sizes for both outcomes were very large, indicating strong clinical relevance. These findings support the efficacy of mindful breathing in reducing both psychological stress and associated musculoskeletal

symptoms in college students during high-stress academic periods.

DISCUSSION

The present study found that a short-term mindful breathing intervention significantly reduced both perceived stress and upper trapezius muscle tenderness in college students during exam periods. The results support the hypothesis that psychological interventions like breathing-based mindfulness can have beneficial effects on both mental and physical health parameters. This aligns with previous studies demonstrating mindfulness's efficacy in stress reduction [8, 9, 11].

The significant reduction in trapezius muscle tenderness is notable and adds to a growing body of literature suggesting a mind-body connection in stress-related musculoskeletal conditions. Chronic stress is known to increase muscle tension through sustained sympathetic nervous system activation, particularly in postural muscles like the trapezius [2, 6]. By promoting parasympathetic dominance, mindful breathing may help reverse this hypertonicity and reduce myofascial tenderness [13, 14].

Our findings corroborate prior research in which mindfulness-based interventions reduced musculoskeletal pain in populations with neck pain, fibromyalgia, and tension-type headaches [12, 15, 16]. In particular, Zetterqvist *et al.* (2021) observed reductions

in upper body tension following brief breathing-focused mindfulness in university students, supporting the results of this study [17].

The statistically and clinically significant decrease in PSS-10 scores highlights the psychological benefit of even a brief (10-minute/day) mindfulness practice. This is consistent with the findings of Khoury *et al.* (2015), who demonstrated that mindfulness interventions under 4 weeks can still yield meaningful reductions in stress and anxiety in student populations [18]. Our intervention was particularly accessible and time-efficient, which is critical for student adherence during busy academic schedules. One limitation of the study is the lack of a control group, which restricts causal inference. However, the large effect sizes and consistency with prior literature suggest a strong likelihood that the intervention itself accounted for the observed improvements [19]. Future studies using randomized controlled designs and electromyography could further elucidate the mechanisms behind these effects.

In conclusion, this study contributes novel evidence to support the use of mindful breathing not only as a psychological stress-relief tool but also as a musculoskeletal intervention. Given its simplicity, low cost, and non-pharmacological nature, this approach can be easily integrated into

student wellness programs and clinical physiotherapy settings alike.

CONCLUSION

The present study demonstrated that a brief, guided mindful breathing program significantly reduced both upper trapezius muscle tenderness and perceived stress in physiotherapy students experiencing exam-related anxiety. These findings underscore the dual benefit of mindfulness in addressing both psychological and physical consequences of academic stress. As a cost-effective, non-invasive, and easily accessible intervention, mindful breathing holds promise for integration into student wellness initiatives and physiotherapeutic approaches for stress-related musculoskeletal discomfort. Further research with control groups and physiological biomarkers is warranted to establish causal pathways and long-term effects.

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