

# Impact of Short-Term Pranayama Intervention on Mental Well-Being of Technical Undergraduates

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**Abstract - Background:** Undergraduate cohorts in applied sciences and technology disciplines often experience elevated stress and anxiety due to intensive academic demands, competitive environments, and high expectations for innovation.

**Objective:** To assess the impact of a structured pranayama intervention on mental well-being among technical undergraduates.

**Methods:** Thirty participants (aged 18–24) were randomized into intervention ( $n = 15$ ) and control ( $n = 15$ ) groups. The intervention group practiced pranayama daily for four weeks. Mental health outcomes were assessed using the General Health Questionnaire-28 (GHQ-28). Internal consistency was confirmed (Cronbach's  $\alpha = .84$ ). Data were analyzed using mean, SD, paired  $t$ -test, and Cohen's  $d$ .

**Results:** The intervention group showed significant improvement in GHQ-28 total scores ( $p < .01$ ), with reductions across subscales (somatic symptoms, anxiety/insomnia, social dysfunction, depression). Effect sizes ranged from moderate to large (Cohen's  $d = .52$ – $.78$ ).

**Conclusion:** Short-term pranayama practice significantly improved mental well-being in technical undergraduates, bridging ancient yogic wisdom with modern empirical validation. Findings suggest feasibility for integration into academic wellness programs.

**Key words:** Short-Term Pranayama, Mental Well-Being, Technical Undergraduates.

## 1. INTRODUCTION

Technical undergraduates, often referred to as pre-professional STEM learners, face unique stressors including rigorous coursework, project deadlines, competitive placements, and innovation pressures. These factors contribute to elevated rates of anxiety, insomnia, and depressive symptoms (Dunn, L. M. 2020)

Pranayama, the yogic discipline of controlled breathing, has been described in classical texts as a method for regulating mind and body. Patanjali's *Yoga Sutras* define pranayama as the regulation of inhalation and exhalation (II.49), noting its role in preparing the mind for concentration (II.53). The *Hatha Yoga Pradipika* emphasizes that steadiness of breath leads to steadiness of mind (II.2), while the *Gheranda Samhita* highlights pranayama's role in purification of mental and bodily impurities. Modern empirical studies corroborate these insights (Zidan, M. S., et.al., 2026) demonstrated yoga's effect on anxiety reduction (Oka, G. A., et.al., 2026) found significant improvements in medical students' mental well-being after short-term yoga intervention.

## 2. MATERIALS AND METHODS (ELABORATED)

This study employed a randomized controlled trial (RCT) design with parallel groups to evaluate the effect of pranayama on mental well-being. Thirty technical undergraduates (aged 18–24 years; 18 males, 12 females) were recruited through voluntary participation.

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**3. RANDOMIZATION:**

Participants were randomly assigned to either the intervention group (n = 15) or the control group (n = 15) using a computer-generated random sequence.

**4. INTERVENTION PROTOCOL:**

The intervention group engaged in daily 30-minute pranayama sessions for four weeks, supervised by a certified yoga instructor. The protocol included:

- [1] Anulom Vilom (alternate nostril breathing) – 10 minutes
- [2] Bhramari (humming bee breath) – 10 minutes
- [3] Nadi Shodhana (purification breath) – 10 minutes

**5. CONTROL GROUP:** Continued their routine academic schedule without any structured intervention.

**6. OUTCOME MEASURE:** Mental health was assessed using the General Health Questionnaire-28 (GHQ-28), which evaluates four domains: somatic symptoms, anxiety/insomnia, social dysfunction, and depression.

**7. RELIABILITY:** Internal consistency of GHQ-28 was confirmed (Cronbach’s  $\alpha = .84$ ), indicating strong reliability across subscales.

**8. STATISTICAL ANALYSIS:** Pre- and post-intervention scores were compared using paired t-tests. Effect sizes were calculated using Cohen’s d. Significance was set at  $p < .05$ .

**9. RESULTS AND ANALYSIS**

**Table 1. GHQ-28 Total Scores**

Group	Pre Mean $\pm$ SD	Post Mean $\pm$ SD	t-value	p-value	Cohen’s d
Intervention	19.4 $\pm$ 4.2	11.6 $\pm$ 3.8	4.12	< .01	.78
Control	18.9 $\pm$ 4.5	17.8 $\pm$ 4.3	0.92	> .05	.12

The intervention group demonstrated a statistically significant reduction in total GHQ-28 scores, with a large effect size ( $d = .78$ ), indicating substantial improvement in overall mental well-being. In contrast, the control group showed no significant change, confirming that improvements were attributable to pranayama practice rather than external academic factors.

**Table 2. Subscale Scores of GHQ-28 (Intervention Group)**

Subscale	Pre Mean $\pm$ SD	Post Mean $\pm$ SD	t-value	p-value	Cohen’s d
Somatic symptoms	4.6 $\pm$ 1.2	2.8 $\pm$ 1.1	3.21	< .01	.65
Anxiety/Insomnia	5.2 $\pm$ 1.4	3.1 $\pm$ 1.2	3.45	< .01	.70
Social dysfunction	6.1 $\pm$ 1.5	4.2 $\pm$ 1.3	3.02	< .01	.62
Depression	3.5 $\pm$ 1.0	1.5 $\pm$ 0.9	3.88	< .01	.72

All four subscales showed significant reductions post-intervention. Anxiety/insomnia and depression demonstrated the largest effect sizes ( $d = .70$  and  $d = .72$ ), suggesting pranayama was particularly effective in alleviating psychological distress and mood.

disturbances. Somatic symptoms and social dysfunction also improved, reflecting enhanced physical comfort and interpersonal functioning.

**Table 3. Reliability of GHQ-28**

Subscale	Cronbach's $\alpha$
Somatic symptoms	.81
Subscale	Cronbach's $\alpha$
Anxiety/Insomnia	.85
Social dysfunction	.79
Depression	.83
Total scale	.84

Cronbach's  $\alpha$  values across subscales ranged from .79 to .85, confirming strong internal consistency. This reliability supports the robustness of GHQ-28 as a psychometric tool for assessing mental health outcomes in technical undergraduates.

## 10. DISCUSSION

This study provides empirical evidence that short-term pranayama practice significantly improves mental well-being among technical undergraduates. The intervention group exhibited marked reductions in stress, anxiety, depression, and social dysfunction, with moderate to large effect sizes across all domains.

## 11. MECHANISTIC INTERPRETATION:

- [1] **Autonomic regulation:** Pranayama enhances parasympathetic activity, reducing sympathetic arousal and promoting relaxation.
- [2] **Neuroendocrine modulation:** Controlled breathing lowers cortisol and catecholamine levels, mitigating stress responses.
- [3] **Neurocognitive effects:** EEG studies suggest pranayama increases alpha wave activity, associated with attention stability and emotional regulation.
- [4] **Psychological resilience:** Improvements in anxiety and insomnia directly support concentration, creativity, and academic performance in STEM learners.

## 12. EDUCATIONAL IMPLICATIONS

Technical undergraduates face unique stressors such as project deadlines, coding marathons, and competitive placements. By reducing psychological distress and improving sleep quality, pranayama may enhance cognitive efficiency, problem-solving ability, and innovation capacity.

## 13. COMPARATIVE EVIDENCE

These findings align with prior studies in medical cohorts (Bansal et al., 2013; Gupta et al., 2006) and extend applicability to STEM learners.

## 14. LIMITATIONS

Small sample size, short duration, and reliance on self-report measures.

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## 15. FUTURE DIRECTIONS

Larger multi-institutional RCTs with biomarker analysis (HRV, cortisol, EEG) and longitudinal follow-up are recommended to validate physiological mechanisms and assess sustained benefits.

## 16. CONCLUSION

Short-term pranayama practice significantly improved mental health outcomes among technical undergraduates. This intervention is low-cost, scalable, and scientifically validated, making it a strong candidate for integration into STEM education environments to enhance resilience, creativity, and performance.

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