

Original Research Article

Effect of yoga on lung function tests and mental health among medical students: a longitudinal before-after study

Sowmya Lingudu^{1*}, M. Vineela Priyanka², Gadam Ramya³

¹Department of Community Medicine, Rangaraya Medical College, Kakinada, Andhra Pradesh, India

²Department of Community Medicine, Government Medical College, Ongole, Andhra Pradesh, India

³Department of Pulmonary Medicine, Rangaraya Medical College, Kakinada, Andhra Pradesh, India

Received: 23 July 2026

Revised: 06 September 2026

Accepted: 09 September 2026

*Correspondence:

Dr. Sowmya Lingudu,

E-mail: drlsowmya45@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Medical students often experience high levels of academic stress, sedentary lifestyle, and irregular routines, all of which can adversely impact both physical and mental health. Yoga, that integrates asanas, pranayama, and meditation, has gained increasing attention in modern health research for its potential holistic benefits. This study aims to evaluate the effect of a structured yoga intervention on lung function tests and mental health among undergraduate medical students.

Methods: A longitudinal pre-post interventional study conducted among medical students who are willing to participate in a 12-week yoga training program, while those with severe respiratory diseases and current smokers excluded. Baseline assessments included pulmonary function tests and mental health evaluation using the Perceived Stress Scale (PSS-10). Participants underwent a structured yoga intervention for an above said period. Post-intervention assessments were performed using the same standardized instruments. Pre- and post-intervention values were compared using appropriate statistical tests, with a p-value <0.05 considered statistically significant.

Results: Mean age of the study participants was 20.3±1.7. Following intervention, the Yoga participants showed significant improvement in pulmonary function parameters, including FEV1, FVC and FEV1/FVC. Mean PSS-10 scores showed a significant reduction, indicating improved mental well-being.

Conclusions: Regular yoga practice was associated with significant improvements in lung function and mental health among medical students. Incorporating yoga into medical education may serve as an effective, low-cost strategy for promoting physical and psychological well-being.

Keywords: Medical students, Mental health, Pulmonary function tests, Perceived stress scale, Yoga

INTRODUCTION

Medical education is characterized by intense academic demands, prolonged study hours, frequent examinations, and increasing clinical responsibilities, all of which contribute to substantial psychological stress among medical students. Persistent stress has been associated with adverse mental health outcomes, including anxiety, depression, emotional exhaustion, and burnout, which may impair academic performance, professional

development, and overall quality of life.¹ Stress may negatively affect health and wellness, leading to detrimental physical and emotional symptoms such as headaches, anxiety, and depression.²

Yoga, an ancient mind-body practice integrating physical postures (asanas), breathing exercises (pranayama), and meditation, has gained recognition as a complementary intervention for promoting both physical and psychological well-being. Previous studies have demonstrated that regular yoga practice can improve

pulmonary function by enhancing respiratory muscle strength, lung capacity, and breathing efficiency, while simultaneously reducing perceived stress through modulation of autonomic nervous system activity and enhancement of emotional regulation. These multidimensional benefits make yoga a promising intervention for populations exposed to chronic stress, particularly medical students.

Physicians must maintain optimal physical and mental health to provide compassionate, empathetic, and patient-centred care.³ Medical students constitute a vulnerable population due to continuous exposure to academic stress, demanding schedules, and limited opportunities for regular physical activity. These factors increase their susceptibility to psychological distress and may adversely affect their physical health, including respiratory function. Since medical students represent the future healthcare workforce, promoting their physical and mental well-being is essential for ensuring both personal health and professional competence.

Although several studies have independently examined the effects of yoga on either pulmonary function or psychological health, evidence evaluating its simultaneous impact on both outcomes among medical students remains limited. Furthermore, longitudinal studies assessing sustained changes following structured yoga interventions are scarce. Therefore, the present longitudinal quasi-experimental study was undertaken to evaluate the effect of a structured yoga program on pulmonary function tests and mental health among medical students. The findings may support the integration of yoga into undergraduate medical curricula as a practical strategy for promoting student health and resilience. The objectives of the study are to assess the effect of structured yoga intervention, thrice a week for about 12 weeks on respiratory function and evaluate the impact of yoga on stress levels among participants using standard stress scale.

METHODS

A longitudinal before–after quasi-interventional study conducted among medical students aged 18–25 years at a Government Medical College. Study period was 9 months from June, 2025 to February, 2026 (excluded May for summer holidays). Students willing to participate in a 12-week yoga training program were included, while those with severe respiratory diseases and current smokers excluded. A total of 100 students were enrolled in the study using simple random sampling technique. To account for potential dropouts and non-response during the study period, an additional 5% was added. Participants were allocated into an intervention group and a control group. The intervention group underwent the structured yoga program for 12 weeks, whereas the control group continued their routine activities without any intervention. Both groups underwent baseline and post-intervention assessment of pulmonary function tests

and perceived stress scale scores. The intervention consists of structured yoga sessions including asanas, pranayama, and meditation for 45–60 minutes per day, 3 days per week for 12 weeks. Lung function parameters (FVC, FEV1, and FEV1/FVC) measured using a spirometer, and mental health was assessed using the Perceived Stress Scale-10.

After obtaining ethical approval from the Institutional Ethics Committee of RMC, Kakinada, informed consent was taken from all the study participants, baseline data was collected. Then the students were trained by Yoga teacher with adherence monitoring for about 3 months. All the sessions were conducted by the same certified instructor following a standardized protocol. The structured yoga intervention consists of: Asanas (Standing, sitting, supine, forward bends, back bends and balancing asanas), Breathing exercises (Anulom Vilom, Ujjayi Pranayama, Bhramari Pranayama, Sohum Pranayama, Kapalabhati etc.) and meditation.

Measurement of pulmonary function tests

After general examination and mental health assessment using PSS-10, we made the participants to get relaxed for some time. In calm and quiet environment, we have measured the pulmonary function parameters with the use of SPIROEXCEL PC based Pulmonary function test instrument under supervision of Pulmonary Medicine experts. The subjects were instructed to assume the correct sitting posture with slight head elevation; nose closed with the nose clip. For every subject a new disposable mouth piece was used and clear instructions were given prior the test. The three spirometry indices measured were FVC (Forced Vital Capacity), FEV1 (Forced expiratory volume at 1st second), FEV1/FVC. The largest FVC and FEV1 were taken among a series of 3 forced expiratory curves.

Perceived stress was assessed using the 10-item Perceived Stress Scale (PSS-10) developed by Cohen et al.⁴ The PSS is a widely used self-administered instrument that measures the degree to which situations in an individual's life are appraised as stressful during the previous month. Each item is scored on a 5-point Likert scale ranging from 0 ("never") to 4 ("very often"), with total scores ranging from 0 to 40. Higher scores indicate greater perceived stress. Data entered into Excel and analyzed using SPSS 25, with descriptive statistics (mean, standard deviation) and inferential statistics (paired t-test), considering $p < 0.05$ as statistically significant. Ethical principles including confidentiality, voluntary participation, and the right to withdraw were ensured.

RESULTS

Mean age of the study participants was 20.3 ± 1.7 . Female proportion was high among both groups. Regarding mode of stay, the majority of participants in both groups were

hostellers (70% in cases and 71.6% in controls), with a smaller proportion being Dayscholars. Socio-economic status distribution was similar across groups, with most participants belonging to the upper middle class (55% of cases and 59% of controls), followed by the middle class (30% and 25%, respectively), and smaller proportions in lower middle and upper classes (Table 1).

Table 1: Socio-demographic characteristics of study participants.

Variable	Category	Intervention group (n=50)	Control group (n=50)
Gender	Male	32%	38.8%
	Female	68%	61.2%
Mode of stay	Dayscholar	30%	28.4%
	Hosteller	70%	71.6%
Socio-economic status	Upper	2%	1.5%
	Upper middle	55%	59%
	Middle	30%	25%
	Lower middle	12%	14%
	Lower	1%	0.5%
BMI	<18.5	10.9%	9.6%
	18.5-24.9	65.5%	63.6%
	25-29.9	21.4%	25.8%
	>30	2.2%	1%
Physical activity	Yes	40%	37%
	No	60%	63%
Duration of exercise	<1 hour	34%	38%
	1 hour	41%	42%
	>1 hour	25%	20%

In terms of BMI, the majority of participants in both groups fell within the normal range of 18.5–24.9 (65.5% in cases and 63.6% in controls), while smaller proportions were underweight, overweight, or obese. Physical activity levels were slightly higher among cases (40%) compared to controls (37%), although a majority in both groups reported no regular physical activity. Among those who exercised, most participants reported exercising for about one hour daily (41% of cases and 42% of controls), followed by less than one hour and more than one-hour durations.

Above table shows the comparison of pulmonary function parameters among yoga participants before and after yoga intervention. After practicing yoga, there was an improvement in all pulmonary function parameters. Forced Vital Capacity (FVC) increased from 2.5 ± 0.68 to 2.86 ± 0.66 , which showed a significance ($p=0.02$). Forced

Expiratory Volume in 1st second (FEV1) improved significantly from 2.86 ± 0.98 to 3 ± 1.13 ($p=0.04$). Similarly, the FEV1/FVC ratio showed a statistically significant increase from 85.8 ± 10.5 to 92.7 ± 8.6 ($p=0.03$). These findings suggest that yoga practice had a positive effect on pulmonary function, particularly on expiratory capacity and airway efficiency. Whereas the pulmonary function parameters among controls before and after the study period. Although slight increases were observed in FVC, FEV1, and FEV1/FVC ratio after the study period, none of these changes were statistically significant. FVC increased from 2.5 ± 0.4 to 2.56 ± 0.58 ($p=0.32$), FEV1 from 2.77 ± 0.45 to 2.82 ± 0.61 ($p=0.15$), and FEV1/FVC ratio from 90.1 ± 6.47 to 91.6 ± 6.87 ($p=0.55$). This indicates that no significant improvement in pulmonary function occurred among controls though they involved in other physical activities like walking, running and playing (Figure 1 and 2).

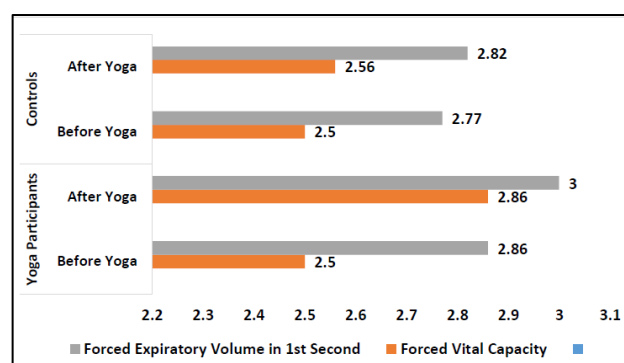


Figure 1: FEV1 and FVC before and after intervention among study population.

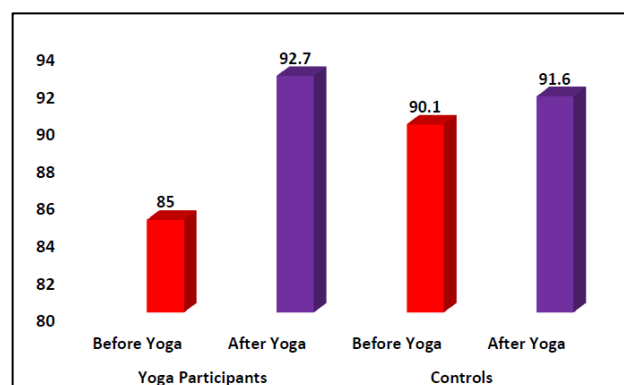


Figure 2: FEV1/FVC among study participants before and after intervention.

At the base line, majority of the participants in both groups had perceived moderate levels of stress according to the Perceived Stress Scale (PSS-10) but after that there was a decreased levels of perceived stress was observed in intervention group i.e., Mean total scores was decreased from 20.33 to 17.89 (Figure 3) when compared to control group 19.54 to 18.32. Among yoga participants, the mean score for feeling upset due to unexpected events decreased from 2.1 ± 0.9 to 1.8 ± 0.8 , and

the score for feeling nervous and stressed decreased from 2.3 ± 0.93 to 1.84 ± 0.85 , indicating improved stress management and emotional regulation following yoga practice. Positive-perception items such as "feeling on top of things" showed a slight improvement (1.75 ± 0.84 to

1.83 ± 0.87). In contrast, the control group exhibited little change in most PSS items. These findings suggest that yoga may enhance coping abilities, reduce perceived stress, and improve psychological well-being among medical students (Table 2)

Table 2: Perceived stress scale among yoga participants and controls before and after intervention.

S. no.	Perceived stress scale	Mean score (yoga participants)		Mean score (controls)	
	Question	Before	After	Before	After
1	In the last month, how often have you been upset because of something that happened unexpectedly?	2.1 ± 0.9	1.8 ± 0.8	2.15 ± 0.94	2.1 ± 0.96
2	In the last month, how often have you felt that you were unable to control the important things in your life?	1.95 ± 0.95	1.97 ± 0.84	1.97 ± 0.94	1.96 ± 0.97
3	In the last month, how often have you felt nervous and stressed?	2.3 ± 0.93	1.84 ± 0.85	2.5 ± 0.88	2.4 ± 0.91
4	In the last month, how often have you felt confident about your ability to handle your personal problems?	2.5 ± 0.88	2.2 ± 0.91	2.3 ± 0.93	2.14 ± 0.85
5	In the last month, how often have you felt that things were going your way?	1.98 ± 0.93	1.95 ± 0.95	1.97 ± 0.96	1.96 ± 0.9
6	In the last month, how often have you found that you could not cope with all the things that you had to do?	2.04 ± 0.87	2 ± 0.88	1.84 ± 0.81	1.88 ± 0.85
7	In the last month, how often have you been able to control irritations in your life?	2.15 ± 0.94	2.13 ± 0.91	1.94 ± 0.85	1.96 ± 0.89
8	In the last month, how often have you felt that you were on top of things?	1.75 ± 0.84	1.83 ± 0.87	1.95 ± 0.95	1.97 ± 0.84
9	In the last month, how often have you been angered because of things that happened that were outside of your control?	1.97 ± 0.94	1.95 ± 0.97	1.83 ± 0.87	1.88 ± 0.9
10	In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	1.84 ± 0.81	1.88 ± 0.85	1.75 ± 0.84	1.8 ± 0.86

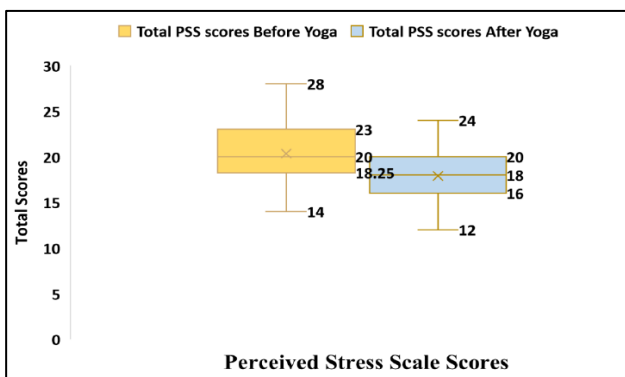


Figure 3: Box and Whisker plot showing the total scores of PSS before and after yoga among intervention group.

DISCUSSION

The present study demonstrated a significant improvement in the pulmonary function tests and mental health of medical students following a 12-week yoga intervention, as evidenced by an improvement in FVC, FEV1, FEV1/FVC and reduction in perceived stress scores. Medical students are frequently exposed to academic pressure, competitive learning environments, prolonged study hours, examinations, and clinical responsibilities, all of which contribute to increased psychological distress. The observed betterment of lung parameters and reduction in stress following yoga practice suggests that yoga may serve as an effective, non-pharmacological strategy for promoting physical and psychological well-being in this vulnerable population.

Vanitha Sharma et al found that practicing Yoga significantly improves breath holding time, MVV and other lung parameters.⁵ VK Rathore et al in their Systematic review and Meta analysis found that yoga intervention (YI) significantly improved FVC%, FEV1 and FEV1% when compared to control groups Pratibha H. Rajbhoj et al, in their study it was found that at the end of the 16-week yoga intervention, the experimental group showed a significant increase in the values of forced vital capacity and FEV1.^{6,7} The data of Behera et al indicated that 6 weeks yoga training improves respiratory functions especially the lung volumes and chest expansions.⁸ Hewett et al in their study showed that 16 weeks of yoga significantly improved perceived stress and self-efficacy in stressed adults, indicating that regular yoga practice can strengthen individuals' confidence in coping with life stressors.⁹

The improvement in mental health observed in this study also has important academic implications. Further evidence comes from Chauhan et al reported that a 10-week yoga program reduced stress, anxiety, and depression and improved quality of life, sleep quality, and emotional regulation among medical students.¹⁰ Their findings suggest that yoga may exert broader benefits on psychological well-being beyond stress reduction alone. Manjula Mehta et al in their study observed that the mean value of PGWBS (Psychological General Wellbeing) before yoga was 69.97 and after yoga it was 80.06 with p value of 0.000.¹ Lona Prasad et al in their study, observed a statistically significant reduction in stress levels from baseline compared to six weeks after the yoga intervention.¹¹

Better psychological well-being may enhance concentration, memory, decision-making, interpersonal communication and academic performance while reducing the risk of burnout. Promoting regular yoga practice within medical institutions may therefore contribute not only to healthier students but also to the development of more resilient and empathetic future healthcare professionals.¹²

Limitations

Although adherence to yoga sessions was monitored, variations in individual participation and practice outside the structured sessions could not be completely controlled. Other lifestyle factors such as diet, sleep, and physical activity may also have influenced the outcomes. Mental health was assessed using a self-reported scale, which may be influenced by reporting bias.

CONCLUSION

The present study demonstrates that a structured 12-week yoga intervention was associated with significant improvements in pulmonary function, as reflected by increased FVC, FEV1 and FEV1/FVC, along with a reduction in perceived stress among medical students.

These findings suggest that regular yoga practice may offer complementary physical and psychological benefits in the context of the academic demands of medical education. Given its low cost, accessibility and feasibility, structured yoga may be considered as a supportive wellness intervention within medical institutions. Further multicentre studies with larger samples and longer follow-up are warranted to establish the sustainability and generalizability of these benefits.

ACKNOWLEDGEMENTS

The authors would like to express sincere gratitude to Dr. B. Devi Madhavi for initiating, conceptualizing the research project and for her invaluable guidance during its development. The authors also extend heartfelt thanks to the yoga instructor, Mr. Arjuna for conducting the yoga sessions with dedication and professionalism. The authors acknowledge the support and assistance of the postgraduate students Dr Kumaran and Dr Aravind who supported this project from the beginning in measuring the Pulmonary function parameters. Finally, authors are deeply grateful to all the medical students who voluntarily participated in this study; their cooperation and commitment made this research possible.

Funding: Multi-disciplinary Research Unit, Rangaraya Medical College, Kakinada

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Mehta M, Taneja P. Effect of short-term yoga practices on psychological general well being in medical students. *J Evol Med Dent Sci*. 2013;2(12):1812-9.
2. Lemay V, Hoolahan J, Buchanan A. Impact of a yoga and meditation intervention on students' stress and anxiety levels. *Am J Pharm Educ*. 2019;83(5):7001.
3. Sunita, Lata M, Mondal H, Kumar M, Kapoor R, Gandhi A. Effect of practicing meditation, pranayama, and yoga on the mental health of female undergraduate medical students: an interventional study. *Cureus*. 2022;14(9):e28915.
4. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav*. 1983;24(4):385-96.
5. Sharma V, Sharma NC, Gupta R, Kapoor M, Chowdhary S. Effect of yoga on lung function test. *JK Sci*. 2022;24(4):231-4.
6. Rathore VK, Singh S, Yadav N. Impact of yoga on pulmonary functions in clinical population: a systematic review and meta-analysis of randomized controlled trials (RCTs). *J Ayurveda Integr Med*. 2025;16(5):101189.
7. Rajbhoj PH, Pathak SD, Patil SN. The effects of yoga practice on lung function and sIL-2R

- biomarkers in individuals working and living in the Lonavala industrial area: a randomized controlled trial. *Indian J Occup Environ Med*. 2023;27(2):159-65.
8. Behera M, Priyadarsini N, Mohapatra D, Mishra T, Behera AA. Role of yoga in study of pulmonary function test in young healthy adults. *Int J Med Res Rev*. 2016;4(6):872-5.
 9. Hewett ZL, Pumpa KL, Smith CA, Fahey PP, Cheema BS. Effect of a 16-week Bikram yoga program on perceived stress, self-efficacy and health-related quality of life in stressed and sedentary adults: a randomised controlled trial. *J Sci Med Sport*. 2018;21(4):352-7.
 10. Chauhan S, Najaf SS, Lukács G, Kinga KA, Karsai I, Prémusz V. Impact of 10 weeks of yoga intervention on mental health and overall well-being among medical students: GSY study. *Sports (Basel)*. 2025;13(4):114.
 11. Prasad L, Varrey A, Sisti G. Medical students' stress levels and sense of well being after six weeks of yoga and meditation. *Evid Based Complement Alternat Med*. 2016;2016:9251849.
 12. Chauhan S, Babu AM, Galgalo DA, Melczer C, Prémusz V, Karsai I. Effect of yoga in medical students to reduce the level of depression, anxiety, and stress: pilot study (Goodbye Stress with Yoga GSY). *BMC Complement Med Ther*. 2024;24: 203.
 13. Pascoe MC, Bauer IE. A systematic review of randomised control trials on the effects of yoga on stress measures and mood. *J Psychiatr Res*. 2015;68: 270-82.

Cite this article as: Lingudu S, Priyanka MV, Ramya G. Effect of yoga on lung function tests and mental health among medical students: a longitudinal before-after study. *Int J Community Med Public Health* 2026;13:5935-40.