

Original Research Article

EFFICACY OF YOGA ON SLEEP QUALITY, ANXIETY, STRESS, AND ACADEMIC PRODUCTIVITY AMONG MEDICAL STUDENTS IN A TERTIARY MEDICAL CENTRE, TRICHY

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ABSTRACT

Background: Medical students often face intense academic demands, prolonged study hours, and sleep deprivation, which can adversely affect both their academic performance and overall health. Yoga, a mind-body practice, has been shown to alleviate stress and promotion of sleep via melatonin control.

Objective: To assess the effectiveness of a yoga intervention in improving sleep quality, reducing anxiety and perceived stress, and enhancing academic productivity among first-year medical students at a tertiary medical college in Trichy, India.

Materials and Methods: A pre-post interventional cohort study was conducted with 250 first-year Bachelor of Medicine, Bachelor of Surgery students. Baseline assessments included the Pittsburgh Sleep Quality Index for sleep, Hamilton Anxiety Rating Scale for anxiety, Perceived Stress Scale for stress, and an academic productivity questionnaire including the Attention Control Scale. Participants engaged in a supervised yoga program consisting of selected asanas, pranayama, and mudras three times a week for 12 weeks. Post-intervention assessments were completed using the same instruments. SPSS 26 was used to analyse data.

Results: Of 250 students assessed, 246 were enrolled and completed both pre- and post-intervention assessments. The mean age of participants was 18.3 ± 1.2 years, with a female predominance (56.4%). Significant improvements were observed in all outcome domains post-yoga intervention: Sleep Quality - Mean Pittsburgh Sleep Quality Index scores improved from 10.82 ± 2.11 to 5.36 ± 1.82 . The mean Hamilton Anxiety Rating Scale score decreased significantly from 15.06 ± 1.87 to 9.68 ± 2 . The Mean Perceived Stress Scale scores reduced from 15.82 ± 2.3 to 10.9 ± 1.78 . Attention and academic scores also improved significantly.

Conclusion: The present study presents strong evidence of the high efficacy of an evidence-based yoga intervention in improving the quality of sleep, reducing anxiety and perceived stress, and improving academic productivity and concentration among first-year Indian medical students.

Keywords: Yoga, sleep quality, stress, anxiety, medical students.

INTRODUCTION

The pursuit of a medical degree is universally recognized as one of the most demanding academic pursuits one can engage in. The perpetual academic

demands, combined with long hours of study, financial pressures, and a highly competitive atmosphere, create the backdrop for intense psychological strain among future doctors.^[1,2] The numbers tell a chilling story that almost half the

students of medicine experience sleep disturbances, anxiety, or depression throughout their medical education.^[3-8]

The signs of chronic stress and poor sleep go far beyond simple fatigue or anxiety. When students are under prolonged pressure, their bodies emit more cortisol, a stress hormone whose harmful effects on the brain regions involved in memory and learning.^[2] In the modern age, one of the ancient practices has been discovered to be a possible solution to today's problems: yoga. This practice of multiple dimensions involving physical postures, breathing, and meditative practices has an advantage that traditional stress management techniques do not account for—an intrinsic way to utilize the mind and the body simultaneously.^[10] The special attraction of yoga to medical students is that it does not only treat symptoms; instead, it appears to attack stress-related problems at the core level through physical changes in the body and the mind.^[9,10]

The physiology behind why yoga works is interesting and well-researched. By practicing yoga daily, our bodies literally experience incredible changes that counteract the effects of chronic stress in direct ways. First, yoga engages what scientists refer to as the "rest-and-digest" response—basically, it teaches our overactive nervous systems how to unwind.^[9-11] This is not a matter of how relaxed you feel; measurable changes in heart rate, blood pressure, and stress hormone levels occur.^[12] Even brief yoga programs have been shown to have significant cortisol decreases, the major stress hormone, and enhanced heart rate variability that reflects a more adaptive stress response.^[12-14]

For sleep-disturbed medical students, yoga is especially promising. Yoga's breathing and mindfulness exercises have been found that it increases melatonin, the sleep-regulating hormone.^[9,14] Yoga students repeatedly report not only sleeping more quickly, but sleeping better, more restfully, and waking more alert during the day.

But yoga's benefits might go even further. Some studies indicate that long-term regular yoga can boost brain-derived neurotrophic factor (BDNF), a protein that stimulates brain cells to grow and make new connections.^[10,15,16] Elevated BDNF is associated with better learning, memory, and stress resistance—just what medical students must excel.^[10]

Objectives: To determine the effect of yoga on sleep quality, anxiety, stress, academic score and attention level

MATERIALS AND METHODS

Materials and Methods

This study is a single-arm prospective interventional study. The study was conducted at Trichy SRM Medical College Hospital and Research Centre, Tamil Nadu during June to October 2023. The study participants were first-year MBBS students. Inclusion criteria were full-time enrollment, general

good health, and willingness to attend all sessions. Exclusion criteria included chronic illness, pregnancy, psychiatric conditions, prior extensive yoga experience, regular use of sleep or anxiety medication, or participation in other structured wellness programs. As a single-arm intervention, randomization was not required.

Sample Size and sampling

The sample size was estimated based on a paired t-test ($\alpha=0.05$, power 80%) to detect a moderate effect (Cohen's $d\approx 0.5$) on PSQI scores, requiring 34–40 participants. To account for attrition, recruitment of ≥ 50 participants was planned; however, all eligible students were enrolled ($n=246$) to enhance statistical power. By Universal sampling approach all 250 first-year MBBS students were selected for participation. After screening for eligibility, 246 students aged 18–22 years were enrolled.

Intervention Protocol

Participants were enrolled in 12-week standardized yoga program which was formulated as per AYUSH guidelines. This program consisted of 20 hours - theory (12 hours) and practice (8 hours). Practical sessions were gender-specific with Females underwent Yoga on Tuesday and Thursdays and male students on Wednesdays and Fridays. The program was supervised by a certified yoga instructor. The sessions combined the below components

1. Asanas (Shavasana, Vajrasana)
2. Pranayama (including Nadi Shuddhi)
3. Mudras (Gyan, Prana)
4. Mindfulness/meditation techniques such as *Yoga Nidra*

Participants were encouraged to maintain a logbook.

Outcome variables

Outcomes were assessed at baseline and post-intervention using by standard validated tools:

- Pittsburgh Sleep Quality Index (PSQI) for poor sleep quality
- Perceived Stress Scale (PSS-10) for stress
- Hamilton Anxiety Rating Scale (HAM-A) for anxiety
- Attentional Control Scale (ATQ): Self-reported measure of concentration and attentional focus.

All tools demonstrated acceptable internal consistency (Cronbach's $\alpha=0.70-0.83$). Data collection was conducted via secure Google Forms and interviewer-administered HAM-A assessments by a blinded psychiatry resident.

Statistical Analysis

Data were analyzed using IBM SPSS version 26.0. Descriptive statistics summarized baseline characteristics. Pre-post comparisons were performed using paired t-tests or Wilcoxon signed-rank tests, depending on normality. Chi square test was used to compare proportions. The p-value <0.05 was considered statistically significant.

Ethical Considerations

The study adhered to ICMR guidelines (2017) and the Declaration of Helsinki. Participation was voluntary, confidentiality was maintained, and no incentives

were provided apart from yoga mats for participants. Ethical approval was obtained from IEC (IEC/2023/Protocol No. 17), and written informed consent was obtained from all participants before start of study.

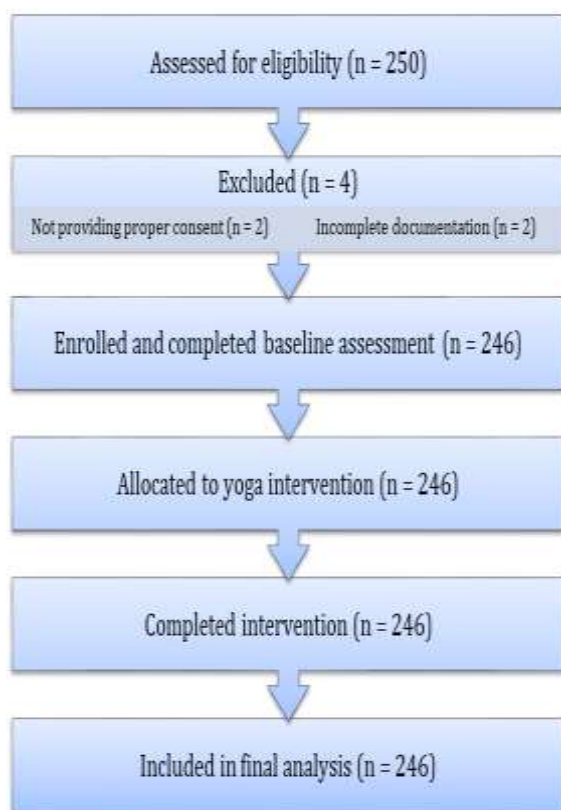


Figure 1: CONSORT-style participant flow diagram for the study

RESULTS

The age distribution shows majority of them were of age 18 years only 7.6% were above age 20. 56.4% were females and around 52.4% were of middle class. [Table 1]

In our study, 8.4% were obese and less than 3% had comorbidities. [Table 2]

The stress and anxiety scoring as per perceived stress scale and HAM A scoring shows there is significant reduction in high grade stress from 4.4 to 0.8% post intervention. Also there was reduction in participants with moderate, severe and very severe anxiety from 18, 1.6 and 0.4% to 6, 0 and 0% in post intervention. The results were significant. [Table 3]

The sleep quality as per PQLI scoring is categorized with 0-5 as good, 6-9 as normal and >10 poor quality sleep. The categorical comparison shows that 14% had poor sleep quality preintervention and it significantly reduced post intervention to only 4.8%. Also, the number of participants with good sleep quality significantly increased post intervention ($P < 0.0001$) as in Figure 2. [Figure 2]

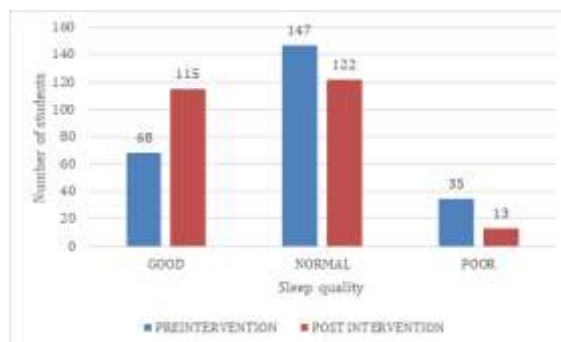


Figure 2: Sleep quality comparison

The Figure 3 shows attention score category – <39-poor, 40-55-moderate or average, 56-67- good and more than 68 as excellent attention. Similarly for academic score, >80-excellent, 65-80- good, 50-65-moderate or average, <50-poor. Following the intervention, there was a significant shift toward higher attention and higher academic performance scores, with a substantial increase in the proportion of students in the good and excellent categories, and a marked decrease in those classified as poor or moderate. This improvement was highly statistically significant ($p < 0.0001$).

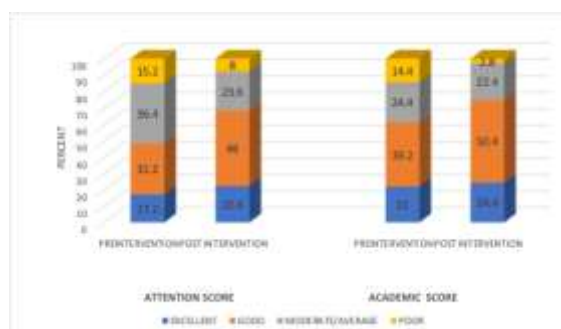


Figure 3: Attention and academic performance score

The higher the attention and academic score higher is the good attention and academic performance whereas higher the PQLI, Anxiety and stress score higher is the severity of poor sleep, severe anxiety and stress.

The mean PQLI score decreased from 10.82 ± 2.11 pre-intervention to 5.36 ± 1.82 post-intervention ($p < 0.0001$), suggesting a significant improvement in sleep quality. The mean anxiety scores reduced from 15.06 ± 1.87 to 9.68 ± 2.01 ($p < 0.0001$). The stress score reduced from 15.82 ± 2.3 to 10.9 ± 1.78 ($p < 0.0001$). The mean attention scores increased from 53.26 ± 7.19 pre intervention to 69.82 ± 9.9 following the intervention suggesting a improvement in attention The academic scores of the participants significantly improved, from 61.12 ± 10.8 pre-intervention to 73.55 ± 12.3 post-intervention ($p < 0.0001$). It is proved from these results that the yoga intervention resulted in statistically significant enhancements in academic performance, anxiety, perceived tension, attention, and sleep quality among medical students. [Table 4]

Table 1: Demographic data distribution

Variables	n	%
Age in years		
18	178	71.2
19	53	21.2
>20	19	7.6
Gender		
Male	109	43.6
Female	141	56.4
Socioeconomic status		
Upper	98	39.2
Middle	131	52.4
Lower	21	8.4

Table 2: Obesity and comorbidities

Variables	n	%
BMI		
Obese	21	8.4
Not obese	229	91.6
Presence of comorbidities		
SHT	3	1.2
DM	1	0.4
Respiratory disease	5	2
Others	3	1.2

Table 3: Stress and anxiety level comparison

Stress level	Pre intervention		Post intervention		P value Chi square test
	n	%	n	%	
Low (0-14)	163	65.2	195	78	0.0014
Moderate (14-30)	76	30.4	53	21.2	
High(>30)	11	4.4	2	0.8	
Anxiety severity					P value Chi square test
	n	%	n	%	
No(0-7)	133	53.2	171	68.4	<0.0001
Mild(8-14)	67	26.8	64	25.6	
Moderate(15-23)	45	18	15	6	
Severe(24-40)	4	1.6	0	0	
Very severe(>40)	1	0.4	0	0	

Table 4: Sleep quality, anxiety, stress, attention score and academic score comparison

Variables -scores	Preintervention	Post intervention	P value
PQLI	10.82±2.11	5.36±1.82	<0.0001
Anxiety	15.06±1.87	9.68±2.01	<0.0001
Perceived stress scale	15.82±2.3	10.9±1.78	<0.0001
Attention	53.26±7.19	69.8±9.9	<0.0001
Academic performance	61.12±10.8	73.55±12.3	<0.0001

DISCUSSION

The study's findings is similar to the existing literature on effect of Yoga on the sleep quality, stress, anxiety, attention levels and academic performance.^[10-12]

The lower the PQLI score the better the sleep quality. In our study, the highPQLI score pre intervention shows the presence of sleep deficiency among medical students. Earlier studies cited above states that more than 50% of students worldwide has sleep issues, with some Indian studies stating over 80% having poor sleep quality.^[2] The reported reduction in PSQI scores (3.2 ± 2.1 points) is particularly noteworthy and is in line with previous studies that have established the effectiveness of yoga to improve sleep quality in various groups, including university students.

The significant declines in the HAM-A and PSS scores are of critical significance, given the staggering levels of anxiety and stress reported

among medical students globally, and most particularly in India. Systematic reviews published recently have reported depression prevalence rates of up to 28% in Indian medical students,^[1] while cross-sectional studies have indicated that almost one-third suffer from anxiety, and as much as 95% suffer from high levels of stress.^[3,4] The overt categorical declines in this study where the percentage of severe anxiety fell from 1.6% to 0% and high levels of stress fell from 4.4% to 0.8% following the intervention are tangible proof of improved mental health outcomes. These results are in harmony with a steadily emerging body of evidence demonstrating that yoga is highly effective at suppressing stress and anxiety, even in high-stress academic environments.^[5,6] This is in line with effective interventions such as "Goodbye Stress with Yoga" among medical students in India, which also resulted in quantitative declines in depression and anxiety.^[15]

The dramatic improvement in attention and academic performance scores is a major finding of this study.

Sleep deprivation and chronic stress have long been established to negatively affect cognitive functions needed for learning and academic performance, resulting in deficits such as compromised executive function, inattentive scattered attention, and decreased working memory.^[7,8] The improvement found is consistent with the expanding literature demonstrating mindfulness and yoga practices can increase cognitive performance, concentration, and decrease mind-wandering in students.^[14] By intervening on the underlying causes of stress and sleep, yoga puts the mind in a healthier place to learn effectively and academically engage.

The positive association between attendance at sessions and observed improvements ($r=0.42-0.61$) is in line with the expectation of a dose-response relationship, a common phenomenon with behavioral interventions. The finding suggests that regular and systematic attendance is an important determinant for maximizing the benefits of yoga and hence has important practical implications for future program design and delivery.

The simultaneous observation of significant improvement in all inter-related areas—sleep, anxiety, stress, and academic performance—provides strong empirical evidence for the theoretical model of medical education as a "perfect storm" of inter-related challenges. Yoga is integrated mind-body involvement practice, which aims to address the cause of disease or disorder, rather than treating symptoms. This sleep and psychological disturbances can be effectively broken by a single, integrative intervention -yoga, which addresses numerous dimensions concurrently. The consistent and strong positive changes that were observed in all of the variables that were measured give empirical proof that this is possible. Not only does this imply that yoga is an unusually effective and holistic intervention, but it also offers a multi-dimensional answer to the interrelated challenges that medical students face. This eliminates the need for specific interventions to address individual issues. Such an integrative style is highly useful for incorporation into rigorous academic curriculum

Limitations: Lack of control group can cause the Hawthorne effect, placebo response, or natural adaptation. This study conducted among first-year MBBS students at a single center could limit generalizability. The follow up of three month is shorter period.

CONCLUSION

The present study presents strong evidence of the high efficacy of an evidence-based yoga intervention in improving the quality of sleep, reducing anxiety and perceived stress, and improving academic productivity and concentration among first-year Indian medical students.

Competing interest: Authors declare no conflict of interest

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Contribution: All authors equally contributed to study data collection and analysis

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