

**Impact of a 10-Week of Yoga Intervention on quality of sleep and stress level among
Medical Students**

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Abstract

Medical education is known to be highly demanding, causing significant stress and having a negative impact on the sleep quality of the students. Addressing these challenges is important as inadequate sleep and elevated levels of psychological distress can have detrimental effects in the cognitive function, psychosocial well-being, and physical health of medical students. This study aimed to investigate the effects of 10-weeks of yoga intervention on the quality of sleep and level of stress, anxiety, and depression of medical student at the University of Pécs, Hungary.

A total of 93 medical students participated in a 10-week Yoga intervention conducted at the University of Pecs with a mean age of 21.18 ± 2.18 years and the BMI of $22.96 \pm 4.21 \text{ kg/m}^2$. The current study employed a pre-post intervention design that included physical postures (asanas), breath regulation (pranayama), and relaxation/meditation practices. Participants completed sociodemographic questionnaires, the Depression Anxiety Stress Scale (DASS-21), and Pittsburgh Sleep Quality Index (PSQI) before and after the 10-week of intervention. The findings indicated a noticeable reduction in the participant's average weight and BMI. The Wilcoxon Signed Ranks Test was employed to compare pre- and post-intervention scores. The test statistics indicated highly significant reductions in Global PSQI Score ($Z = -6.072$, $p < 0.001$), Stress ($Z = -6.038$, $p < 0.001$), Anxiety ($Z = -5.801$, $p < 0.001$), and Depression ($Z = -5.011$, $p < 0.001$) from pre- to post-intervention. These findings suggest that 10 weeks of yoga intervention can significantly enhance the physical and mental well-being of the medical students, improving their weight, BMI, sleep quality, and levels of depression, anxiety, and stress. Future research with larger sample sizes, longer follow-up periods, and the integration of control groups would provide more insights on long-term effects of yoga interventions on the physical and mental health of medical students.

Keywords: Medical students, Yoga, Depression, Anxiety, Stress, Weight, Sleep Disturbance, Mental Health

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Introduction:

Medical education is known to cause a lot of stress and can negatively impact students sleep quality. Due to the demanding nature of the academic and clinical responsibilities, medical students frequently experience elevated levels of stress and poor sleep quality. Sleep quality has a significant impact on cognitive function, psychosocial well-being, and physical health, making it essential for both academic success and general health (Sundas *et al.*, 2020). Medical students are found to have more emotional difficulties, physical, psychological disorders, and mood disorders as they keep thinking about their future and career advancement (Rich *et al.*, 2024). The excessive amount of stress given by the medical school can have detrimental effects on students, which include diminished attention, decreased focus, higher risk of mistakes, absenteeism, and exam cheating. It has been found that medical education is considered as one the world's most stressful academic education affecting the students both mentally and physically (Solanky *et al.*, 2012).

The phrase "Stress" can be defined as the sum of person's physical, mental, and emotional strains or tensions (Schuler, 1980). Stress happens when a person or animal cannot handle real or imagined threats, leading to negative effects. Stress affects every part of the body, changing how people feel and act (Yaribeygi *et al.*, 2017). Examples of stress-related symptoms include palpitations, sweating, dry mouth, shortness of breath, fidgeting, rapid speech, increased negative emotions, and prolonged stress-related fatigue. These changes in the body and mind can lead to psychological and physical disorders, affecting the mental and physical health, and lowering the quality of life (Polmann *et al.*, 2021). Stress among the medical students is consistently greater than those of their classmates in other academic fields. Numerous factors contribute to this stress such as the rigorous classwork, regular exams, long hours, and psychological strain which they experience in the clinical settings. Research has consistently found that medical students commonly experience stress, with female students often showing higher stress levels than males. Moreover, caregiving responsibilities, perceived discrimination and challenges in the work-life balance contribute to heightened stress levels in the students (Bergmann *et al.*, 2019).

A systemic review found out that the medical students go through significant psychological distress that can result in their burnout, anxiety, and depression. This stress can eventually lead to other issues like depression, suicidal thoughts, and drug use. It can also negatively impact

academic performance and overall well-being (Dyrbye *et al.*, 2005). It has been found that stress levels are high during key transition periods in medical education, for example., when students first enter medical school or begin clinical rotations. These times of change bring new challenges and responsibilities, which can significantly increase anxiety and pressure among students (Redwood & Pollak, 2007). Different methods have been investigated to help medical students handle stress, such as mindfulness exercises, stress management courses and improving the emotional intelligence. These approaches are designed to reduce the burnout, boost the satisfaction in the studies, and enhance the overall health & happiness of medical students. By using these strategies, students can find ways to deal with the difficulties of medical school, which helps them feel supported and healthy (Yasien *et al.*, 2016).

Sleep quality can significantly impact the academic performance, physical health, and mental health as it is one of the critical aspects of the overall well-being of the medical students. Several studies have explored the various aspects that affect the sleep quality among this population. Due to increased academic workload and long hours of study, medical students often face sleep disruptions (Abdulghani *et al.*, 2012). This could be because of their lifestyle choices, demanding employment, clinical responsibilities that include midnight on-call shifts, lengthy and intense study sessions, and other factors. Studying how the sleep is affected in undergraduate medical students is important because we know that sleep and mental health are linked. There is also a concern that the heavy workload of medical training can lead to a lot of stress. Undiagnosed sleep problems could worsen mental health in students leading towards lasting effects on their health and the overall well-being (Azad *et al.*, 2015).

Another crucial factor that can affect the sleep quality of medical student is the use of electronic devices and exposure to blue light before the bedtime. This exposure suppresses the production of melatonin hormone that is responsible for regulating the sleep-wake cycle. This can lead to difficulty falling and staying asleep (Chang *et al.*, 2015). Using caffeine and other stimulants that help the students to stay awake and keep up with their studies can also disturb sleep patterns. This dependence may lead to difficulties in falling asleep or staying asleep, which may cause the sleep disruptions and contribute to a poor sleep cycle (Schlarb *et al.*, 2017). Specific demographic and lifestyle factors are linked to the quality of sleep in the medical students. It has been found that the younger students more generally experience lower sleep quality as compared

to the older students and males. This difference in sleep quality may be influenced by various factors such as age-related sleep patterns, hormonal fluctuations, and lifestyle habits. Lifestyle factors, such as exercise, diet and stress management can also play a significant role in influencing sleep quality. Understanding these lifestyle and demographic factors may help develop interventions to improve sleep quality in medical students (Brick *et al.*, 2010). The COVID-19 pandemic has worsened the sleep problems among the medical students. Studies found that during this time the sleep quality has been disrupted, and the occurrence of has increased in the medical students. During this period, the shift of medical schools to online learning has increased stress and have affected sleep (Fowler & Kumte, 2022).

Yoga is an ancient practice that is originated in India thousands of years ago. Yoga integrates the physical poses (asanas), breath regulation (pranayama) and meditation to promote mental and physical well-being (Sengupta, 2012). Yoga comprises various postures such as Hatha yoga, Ashtanga yoga, and others like Satyananda Yoga tradition, aerobic yoga training, Iyengar, Kundalini, and more. These different types of yoga combine techniques like relaxation therapy, meditation, and breath control, which are considered as the essential components of yoga practice (Wegner, 2018). There are several proven benefits of incorporating yoga into one's lifestyle. One of the significant benefits of yoga is its ability to reduce stress and anxiety. Chronic stress has become a common issue in this fast-paced, high-pressure world which can have serious consequences for both physical and mental health. Yoga with its emphasis on mindfulness, deep breathing and relaxation has been found to be an effective tool in managing stress and improving the overall quality of life (Shapiro *et al.*, 2007).

According to the Harvard Mental Health Letter, recent research suggests that practicing yoga can reduce the impact of stress, reduce the anxiety and depression, be a self-soothing technique similar to meditation, relaxation, and exercise and can increase energy (Ross & Thomas, 2010). A review of 12 studies (8 randomized controlled trials) has compared the effect of yoga on the healthy population. It has been found that the people who practised yoga performed significantly well than the non-yoga practitioners in terms of health-related measures such as improved quality of life and stress (Alexander *et al.*, 2013). The benefits of Iyengar yoga that is form of Hatha yoga that emphasizes on alignment, precision, and detail in the performance of postures and breath control, have found to significantly improve various aspects of health and well-being.

Participants who completed 8-weeks of this yoga form reported significant health advantages. There were improvements in self-regulation, better sleep quality, healthier dietary habits, and improved life-style choices. Participants also reported reduced levels of stress and anxiety and developed more calmer mental and emotional state (Linehan *et al.*, 1991). Research have found out that mindfulness and meditation can improve many mental health issues such as anxiety, depression, chronic pain, immune function, blood pressure and cortisol levels. Yoga postures (Asanas) can help people to become more aware about their physical sensations and distinguish them from the emotional responses to traumatic experiences in the past (Balasubramaniam *et al.*, 2013).

Alongside its stress-reducing ability, yoga has been shown to improve the quality of sleep. Insomnia and stress are the common issues, often exacerbated by the stress and anxiety. The emphasis of yoga on relaxation and mindfulness can be an effective non-pharmacological intervention for improving the sleep (Streeter *et al.*, 2012). Yoga improves the quality of sleep by reducing stress and anxiety. Focusing on mindfulness and deep breathing during the yoga practice has been found to lower the cortisol level and increase the gamma-aminobutyric (GABA), a neurotransmitter that promotes the relaxation and calmness. This psychological shift can have an impact on the body's ability to fall asleep and stay asleep throughout the night (Chen *et al.*, 2009). Yoga also improves the sleep architecture, which includes the various sleep stages which are important for the body restoration. It has been found that regular yoga practice can increase the duration of deep, slow-wave sleep which is important for physical and cognitive recovery (Turmel *et al.*, 2022). The enhanced sleep quality can result in the better daytime alertness, improved mood and better cognitive function which is especially beneficial for medical students facing the challenges of their demanding academic and clinical training.

The meditative and mindfulness aspects of yoga can help medical students develop greater self-awareness and emotional control by improving the sleep quality. By engaging in regular yoga practices, students learn to manage the stress and anxiety more effectively that not only enhances their sleep but also contributes to the overall well-being (Cramer, Krucoff, *et al.*, 2013). The benefits of yoga for medical students are evident, but it is essential to ensure that yoga practices are tailored to individual needs and abilities and are led by experienced instructors (Brems *et al.*, 2015). By raising awareness about the advantages of yoga and providing medical

students with opportunities to engage in these practices, educational institutions can contribute to the overall well-being of future healthcare professionals. The primary aim of the current study is to investigate the effect of 10-weeks of yoga intervention on the quality of sleep and level of stress, anxiety, and depression in the medical students.

Hypothesis:

- We hypothesized that there would be a significant difference in the medical student's BMI and weight after the 10 weeks of yoga intervention.
- We hypothesized that there would be a significant decrease in the stress, depression, and anxiety levels after 10 weeks of yoga intervention among the medical students.
- We assumed that the people who participated in the yoga intervention would significantly improve the quality of sleep.

Methods:

The present study utilized a pre-post interventional design utilizing validated questionnaires. The research took place in Ifjúság Street, building B. RG room, Faculty of Sciences TTK, University of Pécs. Data collection was done between September 2023 and November 2023. In this study, all participants enrolled in the "Indian Yoga" physical training program at the University of Pécs, Hungary, between September 2023 and November 2023, were invited to take part in the research.

Sampling Method:

We identified our intervention group by reaching out to Shalini Chauhan, the external consultant of current study and the trainer for the yoga classes. She granted us permission to contact the yoga participants directly to gauge their interest in joining the study. As a result, we were able to include 93 willing volunteers. We conducted the study by administering a pre-intervention questionnaire, followed by a post-intervention questionnaire after a 10-week intervention period.

Inclusion and exclusion criteria:

Participants in the research needed to be registered at the University of Pécs, during the study period.

Exclusion criteria – Students who posed safety risks for participating in a yoga intervention,

such as those with recent injuries or severe joint disease, were not permitted to enroll in the study. Despite these criteria, there were no withdrawals among the participants, and everyone who joined the study met the inclusion criteria and took part. Additionally, none of the participants met the exclusion criteria.

Sample size:

The research included 93 participants and the sampling method included non-random, consecutive sampling. To determine the sample size for our yoga intervention, we initially approached 105 potential volunteers. Out of these, 93 were recruited and actively participated in the study. Their consistent attendance and active engagement throughout the intervention period demonstrated their strong commitment to the research. All participants completed the validated questionnaires.

Details of applied methodology and procedure

Measurement tools:

A sociodemographic questionnaire is an instrument that is used in studies, surveys, or evaluations to gather information about individuals' social and demographic characteristics. It often includes questions about age, gender, race or ethnicity, education level, marital status, household income, employment status, and living conditions. Participants were also asked about their use of walking aids, as well as their height and weight for BMI calculations. This type of survey helps to understand the demographic composition of the population, or a group being studied and the potential relationships and impacts of various demographic factors on specific behaviours or outcomes. To provide a comprehensive understanding of the participants' backgrounds, it typically includes information on socioeconomic status, cultural background, and other relevant social attributes.

- 1. The Depression Anxiety Stress Scale (DASS):** It is a widely used instrument which is developed by Lovibond and Lovibond in 1995 to assess psychological distress across three domains: depression, anxiety, and stress. The DASS consists of 42 items divided into three subscales: Depression, Anxiety, and Stress. Each subscale comprises 14 items that assess the severity of symptoms experienced over the past week. Participants assess the frequency and intensity of their experiences using a Likert scale, ranging from 0 (not applicable at all) to 3 (highly applicable) or most of the

time). The Depression subscale examines feelings of hopelessness, low mood, and diminished interest or pleasure. The Anxiety subscale assesses symptoms. The DASS is utilized in clinical settings for diagnosis, monitoring, and treatment planning for mental health disorders. In research, it informs studies on psychological distress prevalence and correlates. It is also used in occupational settings to assess workplace stress (Lovibond & Lovibond, 1995).

2. **The Pittsburgh Sleep Quality Index (PSQI):** PSQI is a commonly used instrument developed by researchers at the University of Pittsburgh to assess sleep quality and disturbances over a one-month time interval. The PSQI consists of 19 items across seven domains: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medications, and daytime dysfunction. Participants rate their experiences on a Likert scale, providing information on various aspects of sleep patterns and behaviours. The PSQI is commonly used in clinical and research settings to assess sleep quality, identify sleep disturbances, and monitor treatment outcomes for sleep disorders such as insomnia. It provides an important information for diagnosing sleep-related problems and informing interventions to improve sleep health. The PSQI is used in epidemiological studies to investigate the prevalence and correlates of sleep disturbances across different populations (Buysse *et al.*, 1991).

Description of the intervention:

Over a period of ten weeks, from September 11, 2023, to November 25, 2023, students in the study participated in 90-minute yoga classes once a week. Each class followed a standardized schedule and included a variety of exercises. The yoga protocol, named the "GSY Goodbye Stress with Yoga Protocol," was developed collaboratively by a medical researcher, a professional Indian yogi, and a certified yoga instructor. To maximize the benefits of the yoga practice, we began with stretching movements used as warm-up techniques, either sitting or standing, to enhance the body's internal flow.

Yoga Asanas:

- **Standing postures:**

Tadasana (Palm Tree posture): Tada” refers to a mountain. This pose which is the foundation for all standing poses, teaches practitioners on how to achieve balance and steadiness. This pose helps in relaxing the spinal nerves, correcting poor postures, and providing stability to the body (Bharadwaj, 2020).

Pada-Hasatasana (the hands-to-feet posture): "Pada" means feet and "Hasta" means hands. Therefore, Pada-Hastasana indicates to maintain your hand pointing down towards the feet. This pose helps prevent constipation and menstrual issues, enhances digestion, and stretches the spine (Tiwari, 2015).

Ardha cakrasana (The half-wheel posture): “Ardha” signifies half, while “Cakra” indicates the wheel. The pose is named because the body forms a half-round in this pose. This pose helps strengthen the neck muscles, reduce cervical spondylitis, and improve breathing. It also aids in restoring spine flexibility and treating spinal disorders (Kumar, 2003).

Trikonasana (The triangle pose): Trikonasana is a yoga pose where the extremities and the torso are arranged in a triangle with three arms. This posture helps prevent flat feet. It can enhance the spine mobility and promotes the strengthening of calf, thigh, and waist muscles (Bharadwaj, 2020).

- **Sitting postures:**

Bhadrasana (The Firm/Auspicious Posture): This is one of the basic yoga positions suitable for beginners. It provides an ideal opportunity for meditation, improved concentration, and relaxation. This pose targets the abdominal organs, relieving tension and reducing menstrual pain and knee discomfort (Dogra, 1999).

Vajrasana (Thunderbolt posture): This represents one of the asanas performed during meditation and is known as the meditative pose. The final step of the practice involves closing the eyes and aligning the spine. It supports the digestion process. It is recommended that one should practice this position after eating and hold it for more than five minutes. It also contributes to build stronger thigh and calf muscles (Thakur & Bhatnagar, 2016).

Uttana mandukasana (stretched up-frog posture): “Uttana” means upright and “manduka” refers to frog. As the final posture of this position resembles an upright frog. It enhances the breathing capacity and relieves spinal and cervical pain (Ray, 2020).

Vakrasana (the spinal twist posture): The spine's inverted position significantly influences its functionality, improving spine mobility and addressing concern such as gastritis and indigestion (Rathore *et al.*, 2017).

- **Prone postures**

Makarasana (the Crocodile posture): This is one of the initial relaxing poses practiced while lying face down, where the body resembles a crocodile. This position promotes spinal comfort and helps in the healing of back issues (Ray, 2020).

Bhujangasana (the Cobra posture): “Bhujanga” refers to cobra or snake, reflecting the posture where the body is lifted to resemble a snake's head. This pose is beneficial for stress management, reducing belly fat, relieving indigestion, and relieving back pain (Ray, 2020).

Salabhasana (the Locust posture): This position helps to decrease the fat from the kidney region, buttocks, and thighs (Shivakumar & Balakrishna, 2022).

- **Supine postures**

Setubandhasana (the Bridge posture): This pose is named because the body looks like a bridge. It improves digestion, eases indigestion, strengthens lower back muscles, and reduces feelings of anxiety and despair (Tiwari, 2015).

Pavanmuktasana (the Wind releasing posture): “Pavana” means wind and “mukta” signifies to release or to make free. It helps with digestion, relieves diarrhoea, reduces gas, and lessens the feeling of heaviness in the belly (Priya *et al.*).

Savasana (the Death body posture):

“Sava” signifies a dead body. The final position of this asana resembles that of a deceased body. After performing a lot of postures, it is crucial to maintain the proper position to help your muscles to relax and prepare for the following exercise. This posture is particularly beneficial for stress management as it relieves stiffness of all kinds, offering rest for both the body and the mind (Ananda, 1993).

Kapalabhati: The most beneficial breathing technique involves engaging the abdomen muscle to exhale forcefully, while the inhalation should be passive. This technique aids in treating respiratory conditions and clearing the sinuses. It also promotes a youthful and radiant complexion and improves gastrointestinal health (Ray, 2020).

- **Pranayama:**

Nadisodhana or Anuloma Viloma pranayama (Alternate Nostril Breathing): In this breathing practice, alternate between breathing through the left and right nostrils, either fully or partially. The main goal of this pranayama includes nourishing the body, enhancing focus, and reducing tension and anxiety. Furthermore, it aids in alleviating respiratory conditions (Dhanvijay *et al.*, 2015).

Bhramari Pranayama: During the practice of this meditation, a sound resembling the buzzing of a black bee is produced. It lessens tension, anxiety, agitation, and restlessness. The harmonious effect of the buzzing sound soothes the nervous system and the mind (NAKKACH, 2016).

Ethical Approval:

Prior to the start of the study, participants provided their informed written consent by signing a Declaration of Consent Form. Participation in the study was completely voluntary, and participants were allowed to withdraw from the research at any time without having to provide a reason or feeling obligated to do so. Additionally, the participants' anonymity and confidentiality were maintained throughout the study. The study was reviewed and approved by the Institutional Review Board number 9117-PTE 2022 at the University of Pécs, and the Regional Research Ethics Committee. This research was conducted in accordance with the ethical principles outlined in the Helsinki Declaration.

Data Analysis:

Microsoft Excel was used for data processing, and statistical analyses were performed using SPSS 26.0 software (SPSS Inc., Chicago, IL, USA). The demographic information of the research population was summarized using descriptive statistics. The Kolmogorov-Smirnov test was used to assess the data distribution. To compare the mean mobility scores before and after the yoga intervention, a paired t-test or the Wilcoxon Signed Ranks Test was used. A significance level of $p < 0.05$ was considered statistically significant. The data was presented as mean $\pm$ standard deviation (SD).

Results:

The Socio-Demographic Questionnaire

In this study, a total of 93 participants took part in the intervention. Of these, 83 (89.2%) were females and 10 (10.8%) were males. The mean age of the participants was 21.18 ± 2.18 years, with an age range of 18 to 27 years. The average height of the participants was 167.35 ± 7.37 centimetres, and the average weight was 64.40 ± 13.93 kilograms, resulting in a mean BMI of 22.96 ± 4.21 kg/m². In terms of education financing, 57 (61.3%) participants were self-financed, and 36 (38.7%) were supported through different scholarship programs. The majority of the participants, 80 (86%), stayed in a flat, while the remaining 13 (14%) stayed in a dormitory.

Table 1: Descriptive Analysis of Socio-demographic data of the students.

Characteristics	Frequency (n)	Percentage (%)
Number (N)	93	100
Gender		
Male	10	10.8
Female	83	89.2
Age (mean$\pm$SD)	21.18 ± 2.17	
Height (mean)	167.35 ± 7.38	
Weight (mean)	64.41 ± 13.94	
BMI	22.96 ± 4.21	
Education finance		
Scholarship	36	38.7
Self-financed	57	61.3
Stay in Hungary		
Flat	80	86.0
Dormitory	13	14.0

We hypothesized that the 10-weeks yoga intervention would have a significant effect on the participants' weight. Data was collected through a socio-demographic questionnaire to evaluate the impact of the intervention. The data did not follow a normal distribution, as determined by the Kolmogorov-Smirnov normality test. Therefore, the Wilcoxon Test was used for data analysis. From the 93 participants who completed both the pre- and post-intervention assessments, the mean weight before the yoga intervention was 64.41 ± 13.94 kilograms. After

the intervention, the mean weight was 63.16 ± 13.31 kilograms. The difference in weight before and after the yoga intervention was found to be statistically significant ($p=0.001$).

We hypothesized that there would be a significant difference in the stress, depression, and anxiety levels before and after 10 weeks of yoga intervention among the medical students. To prove this hypothesis, participants' levels of depression, anxiety, and stress were assessed using the DASS-21, while sleep quality was evaluated using the PSQI. As the data was not normally distributed shown by the Kolmogorov-Smirnov normality test. The data was analysed by the Wilcoxon Test. The pre-intervention mean score for depression was 11.78 ± 7.937 , and post intervention was 9.55 ± 7.437 , which is statistically significant $p < .001$. The pre-intervention mean score for anxiety was 15.76 ± 7.482 and the post intervention score was 12.77 ± 7.384 with $p < 0.001$ which is statistically significant. The pre-intervention mean score for stress was 19.40 ± 8.520 and the post-intervention was 16.80 ± 8.081 with a p-value of less than 0.001 showing that it is statistically significant. Evaluating the response of participants by PSQI, the pre-intervention mean score for global sleep quality was 32.28 ± 13.836 and the post-intervention was 19.92 ± 11.656 with a p-value of less than 0.001 which is statistically significant.

Table 2: Mean and standard deviation of DASS-21 depression, anxiety, and stress 21 score and Global PSQI scores before and after 10 weeks of yoga intervention in participants

DASS and PSQI	N = 93	Depression	Anxiety	Stress	Global_PSQI
Pre	Mean	11.78	15.76	19.40	32.28
	Std. Deviation	7.937	7.482	8.520	13.836
Post	Mean	9.55	12.77	16.80	19.92
	Std. Deviation	7.437	7.384	8.081	11.656
	Z	-5.011b	-5.801b	-6.038b	-6.072b
	p	<.001	<.001	<.001	<.001

a Wilcoxon Signed Ranks Test				
b Based on positive ranks.				

Discussion:

The findings of the current study suggest that yoga is a potential technique to reduce stress levels and improve the sleep quality among medical students. Sleep disturbance along with the depression is one of the major challenges that is faced by the medical students. These problems may significantly affect a student's quality of life, general wellbeing, and academic achievement. University students have been found to have irregular and delayed sleep cycles which can result in frequent sleep deprivation and sleepiness during the daytime (Palermo *et al.*, 2011). Medical school education is thought to be most demanding which undoubtedly contributes to sleep disruptions and alleviate of stress levels (Abdulghani *et al.*, 2011).

This study investigates the effects of a 10-week yoga intervention on medical students. Anxiety, weight, BMI, and sleep quality were assessed. After ten weeks of yoga intervention, there was a noticeable improvement in the quality of sleep and a reduction in anxiety when compared to baseline values. This initial research shows that the intervention had a positive impact, as supported by the reduction levels for depression, anxiety, stress, and improvement of sleep quality.

Weight and BMI Changes:

When it comes to physiological wellness and sedentary behaviour, yoga can have a particularly positive effect. While the primary focus of the intervention was on mental health and sleep quality, the study also hypothesized changes in the BMI and weight. The results showed that the 10-week of yoga intervention can have a significant reduction in mean weight and BMI of the medical students ($p=0.01$). Although, this moderate but significant decrease suggests that yoga can contribute to weight management. The weight loss can be partly due to the physical activity in yoga, which helps increase metabolism and burn calories. The weight loss findings of the current study are consistent with previous research on the effects of yoga on body composition. A systematic review and meta-analysis examined the impact of yoga interventions on weight-related outcomes. The primary aim of the study was to evaluate how yoga interventions

can effectively target weight-related results, specifically focusing on obesity and its implications for the different health conditions. The review found out that yoga practice resulted in modest but significant reductions in body weight, BMI, and waist circumference compared to control conditions (Rioux & Ritenbaugh, 2013). The physical aspects of the yoga intervention, which included standing, sitting, prone and supine postures played a role in stimulating the metabolism and facilitating the weight loss. This is an important finding as medical students are known to be susceptible to weight gain and other health issues due to high levels of stress and irregular patterns they often experience. Implementing yoga-based interventions along with the breathing exercises and mindfulness techniques in this population can be a valuable approach to support their overall physical well-being and maintaining a healthy weight.

Depression, Anxiety and Stress:

The yoga intervention had the most notable effects on the areas of depression, anxiety, and stress. Using the Depression Anxiety Stress Scale (DASS-21), significant reductions were noted in the mean scores for all the three psychological distress domains. This finding is particularly noteworthy given the high-stress environment that medical students often experience. The population may experience variety of stress factors including academic workloads, long hours, sleep deprivation and the emotional demands of patient care, all of which can have detrimental effects on their physical and mental health (Dyrbye *et al.*, 2017). The depression scores in our study decreased from a pre-intervention mean of 11.78 to a post- intervention mean of 9.55, anxiety scores decreased from 15.76 to 12.77 and stress scores from 19.40 to 16.80 with a p -value($p < 0.001$) obtained from the Wilcoxon signed rank test suggesting that yoga can be effective in terms of reducing depression, anxiety, and stress. The recent pilot study also showed the similar result and shows significant reduction depression ($p = 0.019$) and anxiety level $p = 0.049$ (Chauhan *et al.*, 2024). The mental health improvements seen in this study are consistent with a growing amount of research on the psychological benefits of yoga. A systematic review by Pascoe and Bauer found that yoga can effectively reduce symptoms of depression, anxiety and stress in both clinical and non-clinical populations (Pascoe & Bauer, 2015). This finding also suggests that the regulation of the autonomic nervous system and enhancement of mindfulness and emotion regulation can be some of the main processes underlying yoga's stress-reducing effects. The significant reduction in the stress levels observed in our study is particularly important for the medical students as chronic stress have a

variety of negative effects including impaired academic performance, poor clinical decision-making, and increased risk of burnout (Dyrbye *et al.*, 2017). Yoga can be effective in managing the stress levels of medical students specially during the exam period which can boost their productivity.

Sleep Quality:

The study also observed the significant improvements in the sleep quality of participants as measured by the Pittsburgh Sleep Quality Index (PSQI). With a statically significant reduction ($p < 0.001$), the overall PSQI scores improved from a pre-intervention means of 32.28 to a post-intervention mean of 19.92. Yoga practices such as different physical postures (asanas) and breathing techniques (pranayama) are known to enhance autonomic functions and improve respiratory efficacy which can contribute to better sleep. Additionally, the mindfulness and meditation practices of yoga can reduce the cognitive arousal that often interfere with sleep onset and maintenance. These findings are consistent with a systematic review and meta-analysis that focuses on the effect of yoga on improving the sleep quality and severity in women with sleep problems (Wang *et al.*, 2020). The results of this randomized controlled trial showed that, as compared to the control group, the participating women who practiced yoga had significantly better sleep. It showed positive effect of yoga on sleep quality using the PSQI scores in randomized control trials (RCTs) with a significant SMD of -0.54. Another study published in Journal of Yoga and Meditation found out that a 6-week yoga intervention can improve the sleep quality and reduced insomnia among the nursing professionals during the COVID-19 pandemic (Basavegowda *et al.*, 2023). It highlights the potential benefits of yoga in enhancing sleep quality and quality of life, particularly during times of uncertainty and stress. As with the medical students in our study, nursing professionals are also known to face high levels of stress, long work hours, and disruptions to their sleep patterns, which can have detrimental effects on their physical and mental health. In summary, the findings of the current study, in conjunction with the existing research, suggest that yoga has the potential to positively impact various aspects of an individual's life, regardless of their specific context or population.

Limitations:

The absence of control group is one the main drawbacks of this study. The pre-post interventional design utilized in this research does not allow for the direct comparison between the yoga and a control condition. Control group would help in determining whether the results of

the study or the changes that were seen are due to the intervention or the other factors. The population of the study was predominantly female (89.2%) which may limit the generalizability of the other finding to male medical students. Previous studies suggested that the effects of yoga on physical and mental health outcomes may differ between the genders (Cramer, Lauche, et al., 2013). Future studies should aim to include a more balanced gender representation to explore potential differences in the response to yoga interventions. Another limitation of the current study is relatively short duration of the intervention which was limited to 10 weeks. Although, the findings demonstrate the significant improvements, longer-term follow up studies would be necessary to assess the potential and lasting changes. The study relied on self-reported data from the participants, which may be subject to various biases such as social desirability bias or recall bias. The use of objective measure such as actigraph assessment of sleep quality could provide more reliable and comprehensive data. Despite these limitations, the current study provides a valuable insight into the potential benefits of yoga among the medical students who often experience high stress levels and sleep disturbances. The findings suggest that incorporating yoga programs to the medical curriculum or campus wellness initiatives could help improve the overall well-being of students.

Conclusion:

In conclusion the study revealed that the 10-week yoga intervention had a significant positive effect on the mental health and sleep quality in the medical students. The results revealed statistically significant reductions in the mean scores for depression, anxiety, and stress, as measured by the DASS questionnaire. There was a significant improvement in the overall sleep quality of the participants, as shown by the decrease in the mean PSQI scores. It is particularly important to mention that despite collecting the post data of the study during exam period when the stress level is higher in medical students can significantly reduce by yoga which shows us the necessity of yoga intervention in medical students. These findings suggest that the intervention was effective in improving mental health and sleep quality which highlights its potential benefits for use in clinical and therapeutic settings. However, further research needed with large sample size including control group to strengthen the findings.

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