

Effects of a Six-month Yoga Intervention on Psychological Well-being and Perceived Stress among Undergraduate Healthcare Students: A Quasi-experimental Study

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ABSTRACT

Introduction: Mental health and well-being are among the major concerns among undergraduate healthcare students who often experience high stress levels and poor mental health during training. International statistics show that the prevalence of depression in this group is about 28%, which is consistent with Indian findings. Yoga, as a mind-body practice, is a propitious intervention for improving overall well-being.

Aim: To study the effect of a six-month structured Yoga program on the psychological well-being and perceived stress of undergraduate healthcare students.

Materials and Methods: The study was a quasi-experimental trial to assess the effectiveness of six-month Yoga intervention on psychological well-being and perceived stress among undergraduate healthcare students conducted from February 2021 to September 2021 at School of Yoga Therapy, Institute of Salutogenesis and Complementary Medicine, Sri Balaji Vidyapeeth (Deemed-to-be University), Puducherry, India. At baseline and post-intervention, the levels of psychological well-being and perceived stress were measured using the General Well-Being Schedule (GWB) and Perceived Stress Scale (PSS-10). The Yoga group underwent a six-month yoga practice program, while sex-matched controls did not practice Yoga. A total of 158 participants (Yoga: 78; Control: 80) were analysed. Jeffreys's Amazing Statistics Program (JASP) 0.95.3

for Windows was used for statistical analysis. For normally distributed variables, independent samples t-tests compared means between groups and paired samples t-tests assessed pre-post changes within groups. When variables did not meet normality assumptions, non parametric equivalents, the Mann-Whitney U test and the Wilcoxon signed-rank test, were used. The $p < 0.05$ was considered statistically significant.

Results: A total of 158 participants completed the study. The yoga group had 39 males and 39 females, while the control group included 40 males and 40 females. At baseline, no significant differences were observed between the groups. After the intervention, the Yoga group showed significantly improved well-being and reduced perceived stress ($p < 0.001$ in both cases). In contrast, the control group deteriorated in well-being ($p < 0.001$) with no significant change in stress levels ($p = 0.106$). Between-group comparisons affirmed larger improvements in the Yoga group ($p < 0.001$ in both cases).

Conclusion: A six-month Yoga program proved effective in improving the psychological well-being of undergraduate healthcare students, as well as decreasing perceived stress levels, despite the pandemic-related pressures. The results support the inclusion of Yoga-based interventions into healthcare programs to encourage sustainable mental health and well-being of the population.

Keywords: Adolescent health, Health occupations, Health promotion, Mind-body therapies, Mental health, Stress

INTRODUCTION

Mental health and well-being, as described under Sustainable Development Goal 3.4, has remained a challenge among undergraduate healthcare students [1-4]. As they transition from adolescence to adulthood, this period of identity formation is accompanied by increased stress due to the rising expectations from oneself, family and society, which are common to this phase of development [5].

In a previous meta-analysis, Rotenstein LS et al., (2016) estimated that 27.2% of medical students experienced depression or depressive symptoms in the course of their training [4]. Another meta-analysis by Puthran R et al., (2016), reported a global prevalence of depression among healthcare students at almost 28% [3].

A survey conducted by the Indian National Medical Commission (NMC) Task Force in 2024 reveals that approximately 28% of the undergraduate healthcare students reported that they had been diagnosed with a mental health condition. In addition, 36.4% of the participants believed that they did not have the necessary knowledge and skills to handle the stress [6].

This prevalence of below-average mental well-being among undergraduate healthcare students underscores the need for practical interventions to support students' well-being and improve institutional-level processes for stress management and mental health protection. The traditional Indian method of Yoga, which combines mind-body practices with ethical and behavioural values, is a promising way to promote psychological well-being. However, despite extensive literature on Yoga, long-term, curriculum-based Yoga interventions in this population remain limited. Given the increased mental health challenges in healthcare students, it is timely and justified to consider the alternative and available interventions like Yoga.

In recent decades, Yoga has become the most widely practised mind-body discipline worldwide [7]. However, most healthcare students' understanding of Yoga is often limited to Physical Postures [8]. Maharishi Patanjali, regarded as the first codifier to systematically present Yoga in his Patanjala Yoga Sutras (PYS), defines Yoga as "*Yogaś citta-vritti-nirodhaḥ*" leading to "*tadā draṣṭuḥ svarūpe avasthānam*" (PYS I:2-3), which is interpreted and

translated by RS Bhogal as “Yoga is the cessation of modifications of mind leading to a comprehensive awareness of transcendental nature” [9]. Sri Aurobindo, a renowned Yoga Master of the last century, states, “Yoga is the science, the process, the effort and action by which man attempts to pass out of the limits of his ordinary mental consciousness into a greater spiritual consciousness” [10]. In his work Synthesis of Yoga, he writes, “All life is Yoga” [11]. Yoga Guru Dr. Swami Gitananda wrote, “I prefer that you accept Yoga as a way of life, a way of integrating your whole nature, so that all aspects of your life work in harmony, one with another” [12]. However, most Yoga intervention research ignores its traditional, integral framework and instead focuses on isolated components, such as postures or breathing techniques. In contrast, the present study explores a structured Yoga program that includes Asana, Pranayama, Chalana Kriya, Yogic relaxation techniques, Dharana-Dhyana and foundational Yoga philosophy, with emphasis on Yama and Niyama.

It has been documented that Yoga improves various aspects of health, including physical, emotional, mental, social and spiritual well-being; Its psychological effects include increased body awareness, a better mood and improved overall subjective well-being [13]. The existing literature supports the holistic philosophy of Yoga as a mind-body practice that reduces stress and anxiety, promotes mindfulness and fosters psychological resilience among student populations [14-18]. However, the published literature on Yoga Intervention among healthcare students is limited by intervention duration, sample size, or lack of a control group. This area is also under-researched, so the present study was designed to examine the impact of curriculum-based, structured Yoga programs conducted in hybrid mode, especially in a pandemic academic setting where student well-being issues have intensified.

The present research aimed to fill existing gaps by examining the effect of a six-month, structured, curriculum-based Yoga intervention on psychological well-being and perceived stress in undergraduate healthcare students, delivered in a blended (in-person and online) modality, thereby supporting sustainable health and well-being in educational institutions.

MATERIALS AND METHODS

The present quasi-experimental trial was conducted from February 2021 to September 2021 at School of Yoga Therapy, Institute of Salutogenesis and Complementary Medicine, Sri Balaji Vidyapeeth (Deemed-to-be University), Puducherry, India. The study population comprised first- and second-year undergraduate healthcare students enrolled in the BSc in Allied Health Sciences program, where Yoga was offered as an elective course. As the research was carried out in a real-world scenario, the respondents volunteered to join the Yoga practice group by opting for the Yoga elective course. Since the enrollment in the Yoga course was voluntary, a pure random assignment could not be used. As a result, the present study had a two-arm non randomised pre-post-controlled trial design. The present study was prospectively registered in the Clinical Trials Registry of India (CTRI/2021/02/031331) and given ethical approval by the Institutional Human Ethics Committee (Approval No. MGMCRI/IRC/04/2020/69/IHEC/202).

Sample size calculation: After the population of the study had been defined, the sample size was calculated by power analysis based on the effect size to ensure that the desired power was sufficiently high to test between groups. In order to have some level of statistical strength, we set the value of the effect size (Cohen $d=0.50$) that would represent a moderate, but practically significant difference between groups, set the level of significance ($\alpha=0.05$) and the level of power to 0.80 ($\beta=0.20$) and calculated the minimal sample size (n) at 64 participants each. The target sample size of 77 individuals per group was inflated to account for a predicted 20 percent attrition rate over a six-month period following the intervention.

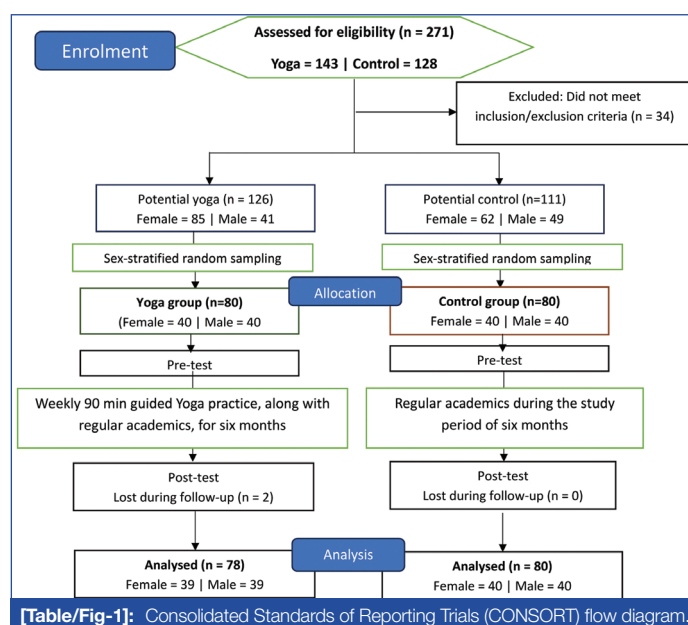
The study population consisted of 271 first and second-year BSc Allied Health Sciences students combined, 143 students who had opted for the elective course in Yoga and 128 possible controls.

Inclusion criteria: The inclusion criteria were BSc Allied Health Sciences students studying at Sri Balaji Vidyapeeth in the age bracket of 17 years to 21 years at the time of recruitment and those who could read, understand and communicate in the English language.

Exclusion criteria: The exclusion criteria were under regular medication for any chronic medical conditions (e.g. psychiatric disorders), those regularly practising Yoga (defined as ≥ 1 session per week for the preceding three months) prior to enrollment, had undergone major injury or surgery within the previous three months, or had an inability to perform the practices.

Study Procedure

After eligibility screening, 126 candidates taking the Yoga elective course were found eligible and 111 possible controls were found eligible [Table/Fig-1]. As the required sample size for the study was calculated to be 77 per group, 80 sex-matched participants were recruited into both the yoga group and the control group. This ensured equal sex distribution (40 males and 40 females) in both groups. All recruited participants provided written informed consent and the baseline assessment included measures of perceived stress and psychological well-being. This was followed by a six-month Yoga intervention between March and August 2021 for the Yoga group and regular academics without the yoga intervention for the control group, all students at the same University campus. Two participants in the Yoga group dropped out before the post-intervention assessment because they had withdrawn from their respective University programs. The final sample that was analysed comprised a total of 158 participants, with 78 in the Yoga group and 80 in the control group.



Assessment tools: The Yoga and control groups were assessed at two stages, before and after the intervention. Psychological well-being and perceived stress were assessed using validated self-report instruments.

The GWB Schedule was used to measure psychological well-being; it is a self-administered questionnaire with 18 items that were developed by the National Center for Health Statistics (NCHS), United States. It is a version of the original 33-item scale, but it has 18 core items that demonstrate good internal consistency and construct validity. It consists of 14 items using 6-point scales and 4 items using 0-10 rating, with an overall score ranging from 0 to 110, in which higher overall scores represent higher psychological well-being [19].

The PSS-10 was used to measure the perceived psychological stress. It evaluates how respondents perceive their lives as unpredictable, uncontrollable and how they feel they have overloaded their lives within the past month. The scale is a 10-item scale on a 5-point Likert scale, where 0=never and 4=very often, with an overall score ranging from 0 to 40, with a higher score indicating more perceived stress [20].

Yoga intervention: The hybrid format guided Yoga sessions were organised between March 2021 and August 2021. The first, fifth and sixth-month sessions were conducted in-person on the University campus, whereas the second, third and fourth-month sessions took place online through the Zoom platform due to Coronavirus Disease-2019 (COVID-19) lockdown restrictions. A weekly 90-minute practice session was held every Friday and consisted of the practices outlined in [Table/Fig-2].

Yoga technique	Duration (in min)
Prayer and breath awareness	3
Chalan Kriya/Jathis	8
Surya Namaskar	7
Ardha Kati Chakrasana/Trikonasana	3
Tadasana	2
Vrikshasana	2
Badhakonasana	2
Shashankasana/Paschimottanasana	2
Ushtrasana/Ardha-Ushtrasana	2
Pavanamuktasana	2
Setubandhasana	2
Ekapada-Uttanapadasana	2
Jatharaparivartanasana	3
Makarasana	4
Shalabhasana/Ardha-Shalabhasana	2
Brahmamudra/Vyagrah Pranayama	4
Kapalabhati	1
Nadishodhan Pranayama/Bhramari Pranayama	5
Kayakriya/Savitri Pranayama	5
Pranava Pranayama	6
Shavasana	8
Dharana/Dhyana	3
Yoga philosophy	12

[Table/Fig-2]: Yoga practice protocol.

In addition to the practices mentioned in [Table/Fig-2], the participants also performed a meditative Asana of their choice, choosing from Padmasana, Ardha-Padmasana, Vajrasana or Sukhasana during the practices in Prayer and breath awareness, Brahmamudra and Nadi Shodhana/Bhramari Pranayama and Dharana/Dhyana. The time durations mentioned in [Table/Fig-2] indicate the total time (in minutes) allotted for each practice, including not only the maintenance of the final posture but also the transition phases. In the first few weeks, the participants performed a greater number of repetitions to get acquainted with the practices. With the progression of the program, the emphasis was on gradually increasing the holding duration of the final posture in the Asana practice. While also doing the pranayama practices, participants received instructions that were progressive in nature to lengthen the duration of their breath in a comfortable manner. The Yoga Philosophy component comprised of the Ashtanga Yoga of Maharishi Patanjali [21], with special emphasis on Yamas and Niyamas, the first two limbs. The primary emphasis was on developing Ahimsa (non violence), one of the Yamas and Santosha (contentment), one of the Niyamas. The practice of Ahimsa was based on the principle of Pratipaksha Bhavana (cultivation of opposing attitudes), as presented in the

ancient Yoga Scripture, PYS II:33, where participants were directed to consciously activate the feeling of Shanti (peace) as the opposite extreme of the emotions linked to aggression and irritation. To practice the concept of Santosha, participants were guided to consciously invoke a feeling of gratitude for the good things in their day-to-day life, including being able to breathe and move various body parts, among other factors. These factors represented the 90 minutes of the structured six-month Yoga intervention each week. Regular academics continued during the study period of six months for the control group.

STATISTICAL ANALYSIS

The JASP 0.95.3 windows version was used to perform the statistical analysis. Firstly, the data were evaluated to determine whether they were normal or not using the Shapiro-Wilk test. In the case of normally distributed variables, independent samples t-tests were used to determine the difference in means between the yoga and control groups and paired samples t-tests were used to determine the pre-post changes within the groups. In cases where the variables failed to meet the normality assumptions, non parametric tests, specifically the Mann-Whitney U test and the Wilcoxon signed-rank test, were employed. A two-tailed $p < 0.05$ was considered statistically significant. The Pearson's correlation coefficient (r) was used to test the relationship between GWB and PSS.

RESULTS

A total of 158 participants completed the study. The yoga group consisted of 78 participants (39 males and 39 females), while the control group included 80 participants (40 males and 40 females).

General Well-Being Schedule (GWB)

The results of the Shapiro-Wilk test showed that the data were normally distributed at the baseline [Table/Fig-3]; however, the post-intervention distributions of one or both groups did not follow the normality assumption. In this regard, paired-sample t-tests were used for normally distributed data, while the Wilcoxon signed-rank test and Mann-Whitney U test were used for non normally distributed data. No significant difference was found in general well-being between the Yoga and control groups at baseline, with 65.62 ± 10.32 and 67.18 ± 13.91 , respectively; $t = 0.799$, $p = 0.426$. The Yoga group reported a significant improvement in well-being (73.79 ± 12.44) after six months ($t = 6.981$, $p < 0.001$), whereas the control group reported a significant decline (59.19 ± 15.75) ($W = 2576.5$, $p < 0.001$). Between-group analysis of the post-intervention group, based on the Mann-Whitney U test, showed a highly significant difference in favour of the Yoga group ($U = 4809.5$, $p < 0.001$).

Perceived Stress Scale (PSS)

The results of the Shapiro-Wilk test indicated that the data had a normal distribution. There was no significant difference, as indicated by the t-test statistics, in PSS scores between the control and Yoga groups at baseline [Table/Fig-4], with mean values of 18.67 ± 4.57 and 19.41 ± 4.49 , respectively; $t = 1.034$, $p = 0.303$. At the six-month follow-up, the scores in the Yoga group decreased significantly (16.26 ± 4.55), as indicated by the t-test statistics ($t = 4.011$, $p < 0.001$). In contrast, the control group, which showed minimal fluctuation (20.19 ± 4.88), yielded statistically insignificant results according to the t-test ($t = 1.635$, $p = 0.106$). The difference in the post-intervention between-group comparison revealed that the difference was statistically significant in favour of the Yoga group, $t = 5.236$, $p < 0.001$.

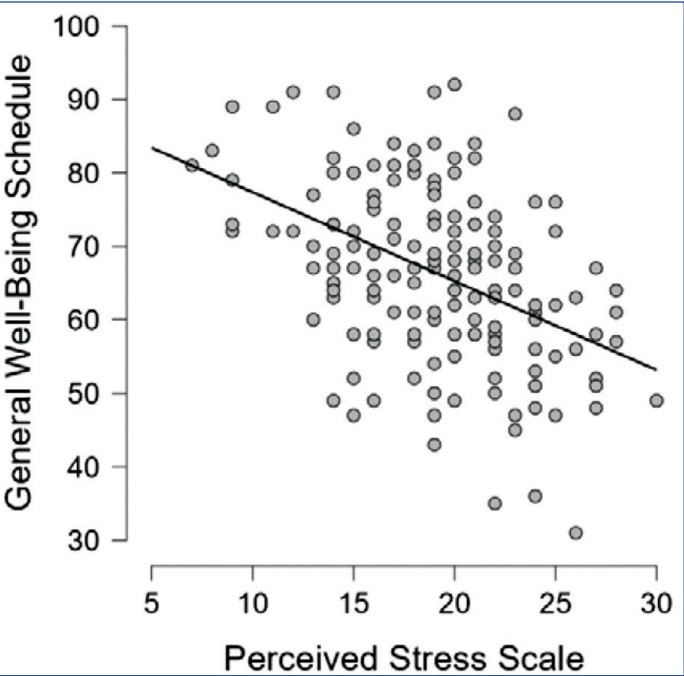
The results of Pearson's correlation statistics between PSS and GWB showed a moderate inverse correlation with Pearson's $r = -0.447$ ($p < 0.001$) [Table/Fig-5]. A negative correlation indicates that higher perceived stress was associated with lower psychological well-being.

GWB	Yoga group		Control group		Effect size	Test	p-value
	Mean±SD	Median (IQR)	Mean±SD	Median (IQR)			
Pre	65.62±10.32	66 (59.25,72.75)	67.18±13.91	68.5 (57.75,77.25)	cd=0.127	it=0.799	0.426
Post	73.79±12.44	75 (66.25, 83)	59.19±15.75	60 (50,69.25)	mr=0.542	MW=4809.5	<0.001*
Effect size	cd=0.79		mr=0.716				
Test	pt=6.981		W=2576.5				
p-value	<0.001*		<0.001*				

[Table/Fig-3]: General Well-Being Schedule (GWB) Scores pre- and post-intervention in yoga and control groups.
Note: SD: Standard deviation; IQR: Interquartile range; pt: Paired t-test (within groups); it: Independent t-test (between groups); W: Wilcoxon signed-rank test; MW: Mann-Whitney U test; *ps0.05 is considered as statistical significance; cd = Cohen's d; mr: Matched rank biserial correlation

PSS	Yoga group		Control group		Effect size (Cohen's d)	Independent t-test	p-value
	Mean±SD	Median (IQR)	Mean±SD	Median (IQR)			
Pre	18.67±4.57	19 (15.25,22)	19.41±4.49	19 (16,23)	0.165	1.034	0.303
Post	16.26±4.55	16 (13,19)	20.19±4.88	20 (18,23)	0.833	5.236	<0.001*
Effect Size (Cohen's d)	0.454		0.183				
Paired t-test	4.011		1.635				
p-value	<0.001*		0.106				

[Table/Fig-4]: Perceived Stress Scale (PSS) scores pre- and post-intervention in yoga and control groups.
Note: SD: Standard deviation; *ps0.05 is considered as statistical significance; Correlation between Perceived Stress Scale (PSS) and General Well-being Schedule (GWB)



[Table/Fig-5]: Scatterplot denoting correlation between Perceived Stress Scale (PSS) and General Well-Being (GWB) schedule.

DISCUSSION

The present study was conducted to address the limited understanding of the effects of structured, curriculum-integrated Yoga interventions among undergraduate healthcare students during the COVID-19 Pandemic, with the aim of informing the development of healthcare interventions in educational settings.

The findings of the present study revealed that participation in a six-month structured and guided Yoga intervention, delivered in a hybrid format (three months in-person and three months online), was associated with a significant improvement in psychological well-being (p<0.001) and a corresponding reduction in perceived stress (p<0.001), among undergraduate healthcare students. In contrast, the control group demonstrated a decline in well-being (p<0.001) and a marginal, non significant increase in stress during this period (p=0.106).

The results align with prior studies, which have shown that Yoga intervention improves and positively affects University students and is also effective in alleviating perceived stress, anxiety and depressive symptoms [22,23].

The parallel deterioration of psychological well-being in the control group can be better understood within the broader context in which the study was conducted. The survey was conducted between February and September 2021, a period when students were re-adapting to academic and social schedules that had been disrupted by the COVID-19 pandemic [24,25]. Continuous disturbances to social life, educational conditions and a lack of confidence in future professional growth opportunities were actively discussed as factors that escalate stress levels and deteriorate the well-being of healthcare students globally [26-29]. Accordingly, the deterioration of the control group might be due to the residual psychological impact of long-term pandemic-related stressors. Conversely, all participants in the Yoga group showed significant improvements in psychological well-being, despite the difficulties, indicating that Yoga practice is likely to have boosted resilience and stress-coping ability. This aligns with the findings of other yoga intervention studies that had been carried out during the COVID-19 pandemic [30-34]. Brandão T et al., (2024) found that online Kundalini Yoga improved self-compassion, emotion regulation and spiritual well-being among University students, with sustained reductions in depression, anxiety and stress [31]. Another study examining the impact of yoga practice on stress levels during the COVID-19 pandemic compared 51 female yoga practitioners with 50 non practitioners and found significantly lower stress levels in yoga practitioners, as well as reduced anxiety and depression, compared to controls [32]. Somere K et al., (2024) found that a 10-week online yin yoga intervention significantly reduced state anxiety compared with controls (p <0.05), among Latvian women [34].

The high-value negative relationships between the GWB and PSS scores also confirm the mutual relationship between psychological well-being and perceived stress, i.e., higher psychological well-being consistently corresponded with lower perceived stress.

Psychophysiological and Salutogenic Mechanisms Underlying Yoga Practice

In the Salutogenic framework of Antonovsky A (1996), the origins of health (saluto-genesis) are rooted in the emergence of Sense of Coherence (SoC), which is a pervasive, dynamic orientation reflecting confidence that one's internal and external environments are comprehensible, manageable and meaningful [35]. According to Antonovsky A, SoC enables individuals to perceive life as structured, predictable and explicable, thereby enhancing their capacity to cope effectively with stress [36]. The results of the current research are consistent with the Salutogenic model, as the participants in

the Yoga group exhibited higher well-being and lower perceived stress, which is associated with an enhanced feeling of coherence and self-regulation. Therefore, Yoga can make SoC stronger by promoting the feelings of comprehensibility (that my world can be understood), manageability (that my world can be managed) and meaningfulness (a sense of purpose and interconnectedness). This offers a conceptual map for integrating the practice of Yoga into healthcare education to achieve resilience and holistic well-being.

Healthcare training is inherently demanding and often associated with high levels of stress, burnout, emotional exhaustion and reduced empathy among students [1,37]. The observed benefits of Yoga in improving psychological well-being and reducing perceived stress levels indicate its potential feasibility, practicality and effectiveness for building resilience within the purview of Institutional Well-being models. Implementing Yoga-based courses in healthcare programs can not only establish self-care and emotional regulation but also promote integral growth and professional empathy, a key competence in any healthcare provider who must cope with personal and patient-related stressors.

Implications of the study: The results of the study suggest that Yoga has the potential to be an effective, evidence-based measure for improving resilience and psychological well-being in healthcare students. The fact that this six-month intervention was feasible helps argue at the policy level to include Yoga in healthcare programs as an aspect of institutional well-being frameworks. Theoretically, the findings are consistent with the Salutogenic perspective, which posits that Yoga promotes a SoC, self-regulation and psychological resilience.

Limitation(s)

Although these are promising results, a number of limitations must be acknowledged. The design is non randomised, which restricts causal inference, but this method was required by the nature of the educational setting in the real world, where students voluntarily selected to participate in the Yoga program. Even though sex-matched stratified sampling and similar baseline characteristics served to reduce possible selection bias, residual confounding cannot be completely ruled out. The unique conditions of the COVID-19 pandemic may also possibly affect the state of the students' well-being outside the paradigms of the intervention. However, the presence of a concurrent control group enhanced the internal validity by controlling for common environmental and temporal effects.

CONCLUSION(S)

Within the limitations of the present study, the research provides empirical support that a curriculum-based Yoga program delivered in a hybrid format can significantly enhance psychological well-being and reduce perceived stress in undergraduate healthcare students. In contrast, the control group showed deterioration in these domains. Integrating Yoga in healthcare curricula can strengthen psychological well-being and reduce stress, contributing to building a more balanced and compassionate future healthcare workforce.

Future studies employing randomised controlled designs, larger and more diverse samples and multi-institutional participation is suggested and can be explored to confirm these findings across diverse educational contexts and to elucidate underlying mechanisms through physiological or neurobiological measures.

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