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Effect of Yoga on Vital Physiological Indicators and Mental Health among Undergraduate Medical Students

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ABSTRACT

Introduction: Yoga is an ancient practice originating from India that has been potentially used to improve physical, mental, and spiritual health. The long-term effects of the practice of yoga are evident; however, the immediate impact of yoga is not very well established, particularly among the population with high academic stress, like medical students.

Objective: To investigates the physiological and psychological impacts of a 12 week yoga and meditation program on undergraduate medical students at Madan Bhandari Academy of Health Sciences.

Methods: By employing cross-sectional analytical design, the target population of 80 students were grouped into the yoga group and the control group. The pretest and post test data of yoga group on the key health indicators, including the pulse rate, systolic and diastolic blood pressure on the student's health profile, were taken before and after the student underwent the intervention. The Sahaja yoga technique was applied in the intervention.

Result: The results revealed significant reductions in heart rate (15.53%) and blood pressure (Systolic blood pressure by 6.12% and Diastolic blood pressure by 13.25%) in the yoga group compared to the control group (4.43% HR, +1.84% Systolic blood pressure, and 2.13% Diastolic blood pressure, all $p < 0.001$), alongside improvements in perceived stress and anxiety levels.

Conclusion: The study concludes that a 12-week yoga and meditation program significantly improved both physiological parameters and psychological wellbeing in undergraduate medical students.

Keywords: Diastolic blood pressure; heart rate; systolic blood pressure; yoga.

INTRODUCTION

Yoga is an ancient Indian science that is claimed to help develop perfect physical, mental, and spiritual health. Several scientific studies have been conducted previously on Yogis who have been practicing yoga for several years.

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It has been observed that yogis can reduce their oxygen utilization[1] and also control their pulse through respiratory maneuvers.[2] Yogis are reported to possess a reduced level of sympathetic tone [3] and exert a certain degree of voluntary control over autonomic functions. The practice of specific yogic exercises has proved to be useful in physiological indicators and mental health. [4] Both meditative and power yoga have been reported to decrease stress levels over time. [5, 6, 7] .Smith et al. showed a 10-week Hatha yoga intervention decreased anxiety and improved quality of life scores over time. [5] This is supported by reports of decreased physiologic stress outcomes (i.e., cortisol) with meditative yoga practice. [8] A 6 week program of power yoga has been shown to decrease perceived stress over time while also improving parasympathetic function while performing Sudarsan Kriya. [7] Intensive breathing training using SKY approach improves anxiety and/or depressive disorders as well as CAC and cardiorespiratory coupling.[6] Although yoga is proved to be useful in normal and in diseased conditions, there are limited studies on the effect of yoga on medical students who are under stress due to demanding curriculum and unlimited testes and assignments.

METHOD

This study employs a quantitative research method to investigate the impact of yoga and meditation on the Physiological parameters and mental health state of the participants. First and second-semester undergraduate students of Madan Bhandari Academy of Health Sciences were surveyed using the census sampling technique to calculate the sample size. The sample size for both the Yoga and control group is 40 each. Study was conducted from 2023 to 2024. For this, a cross-sectional analytical study design was used. After obtaining the ethical approval IRC-037-079 from the

institutional review committee study was conducted. Students were informed about the procedure and filled out the consent form. The second-semester students comprised the experimental group; they undertook a yoga and meditation program for 12 weeks. The group that did not have any exposure to yoga or meditation assignments during the 12 week was the first-semester students (control group). By interviewing each of them it was confirmed that none of the first semester students practiced Yoga on a regular basis and hence were deemed suitable for our study. However, students who were on any form of medication during the study period were excluded from the experiment.

Collection of data was done at two times: at the beginning of the study before the commencement of the yoga and meditation program (pre-intervention) and at the end of the duration of the intervention (post-intervention) for the experimental group. Data collection was done every week for 12 weeks. The Sahaja yoga technique was used as yogic intervention for 15 minutes and breathing exercise for 5 minutes. Sahaja Yoga is a spiritual meditation technique founded by Shri Mataji Nirmala Devi in 1970. It is based on the belief that Self-Realization (the awakening of inner energy) is the key to achieving inner peace, balance, and spiritual growth. The central focus is on the awakening of the Kundalini energy, which lies dormant at the base of the spine. The first set of variables involved physiological measures, including blood pressure and pulse rates, while the second set involved the use of a General Health questionnaire. All the data, including heart rate (HR), systolic blood pressure (SBP), and diastolic blood pressure (DBP), that were collected were first recorded on paper and then transferred to a Microsoft excel sheet. The data was first checked for normal distribution which showed approximately Normal behavior. Then, the data was exported to a statistical analysis program, SPSS, where statistical tests such as descriptive statistics (mean, standard deviation), paired t-tests, and comparative analysis between experimental and control groups were conducted to determine the impact of yoga intervention.

RESULT

The sample comprising students included 80 individuals, with 40 subjects in the Yoga Group (YG) and 40 subjects in the Control Group (CG). Some of the characteristics that were compared between students in each of the groups are age, height, and weight. (Table 1) gives the initial details of the subjects in both the Yoga Group (YG) and the Control Group (CG).

Table 1: Baseline characteristics.

Sl. No.	Total No. of students (n=40+40)	Yoga Group (YG) (n = 40)	Control Group (CG) (n = 40)
1	Age (Years)	18.34 ± 1.70 1.70	20.14 ± 2.04
2	Height (cm)	162.74 ± 8.03	163.24 ± 6.88
3	Weight (kg)	50.16 ± 8.24	50.46±6.71

A comparison of pre and post-intervention values of both the control and the yoga group, alongside the change in parameters between both groups along with post-intervention values of the yoga group as well as differences between the two groups. (Table 2) The yoga group showed a significant reduction in heart rate from 96.36 ± 5.85 beats/min to 81.48 ± 7.07 beats/min ($p < 0.001$). In contrast, the control group only showed a moderate reduction from 96.33 ± 5.43 beats/min to 92.04 ± 5.68 beats/min ($p < 0.01$). On the other hand, both SBP and DBP decreased significantly, from 120.59 ± 7.54 mmHg to 111.80 ± 4.93 mmHg ($p < 0.01$) and from 78.23 ± 7.79 mmHg to 64.93 ± 4.80 mmHg ($p < 0.001$), respectively, among the yoga group. Meanwhile, the control group had a slight increase in SBP from 122.42 ± 8.37 mmHg to 125.75 ± 8.37 mmHg ($p < 0.01$) and a smaller decrease in DBP, from 77.21 ± 5.88 mmHg to 74.08 ± 5.84 mmHg ($p < 0.001$).

Table 2: Group difference in terms of heart rate, SBP and DBP.

Sl. No.	Parameter	Yoga Group (YG) n=40 Mean+ SD		Control Group (CG) n=40 Mean+ SD	
		Before	After	Before	After
1	HR (beats/min)	96.36 ± 5.85	81.48 ± 7.07***	96.33 ± 5.43	92.04 ± 5.68**
2	SBP (mmHg)	120.59 ± 7.54	111.80 ± 4.93**	122.42 ± 8.37	125.75 ± 8.37**
3	DBP (mmHg)	78.23 ± 7.79	64.93 ± 4.80***	77.21 ± 5.88	74.08 ± 5.84***

The Yoga Group showed a significant percentage change in heart rate, with a 15.53% ± 3.34% reduction from baseline. In comparison, the control group only showed a 4.43% ± 3.26% decrease. While the yoga group experienced a 6.12% ± 3.70% reduction in systolic blood pressure and 13.25% ± 5.22% from baseline, the control group showed only a 1.84% ± 2.34% systolic and 2.13% ± 3.18% diastolic reduction. This demonstrates that yoga has a more substantial effect on reducing heart rate, systolic blood pressure, and diastolic blood pressure. (Table 3)

Table 3: Percentage difference between groups.

Sl. No	Parameter	Yoga Group % Change from Baseline	Control Group % Change from Baseline	p-value versus Control
1	HR(Beats/min)	15.53 ± 3.34	4.43 ± 3.26	<0.001
2	SBP (mm of Hg)	6.12 ± 3.70	1.84 ± 2.34	<0.001
3	DBP (mm of Hg)	13.25 ± 5.22	2.13 ± 3.18	<0.001

In the same way, Figure 1 shows the change in heart rate over the study period of 12 weeks for those who practiced yoga (Yoga Group) and those who did not (Control Group). This line graph depicts that the average heartbeat rate of the yoga group decreased significantly by the end of the period, as compared to the control group, whose rate was seen to fluctuate with no considerable decrease in the value at the last week.

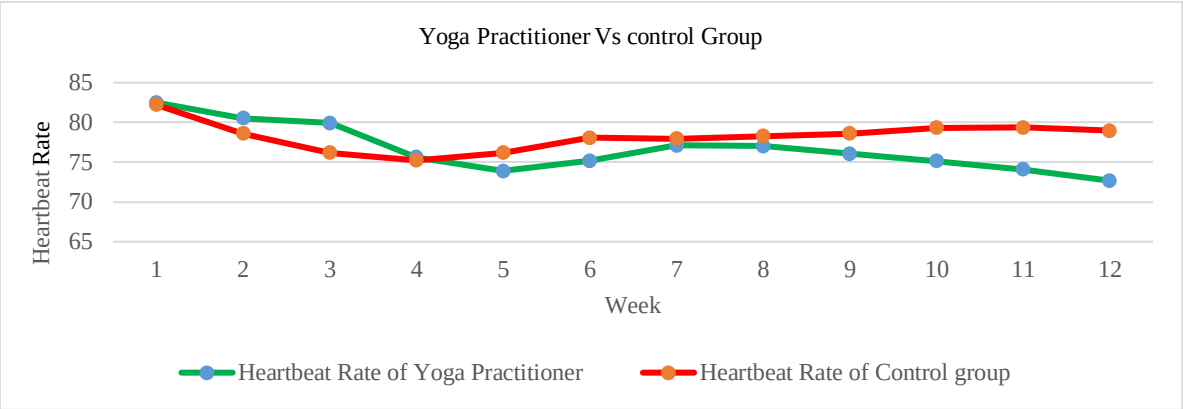

Figure 1: The Heartbeat Rate over 12 Weeks

The results from the paired t-test are as shown in (Tables 4) and (Table 5) for the yoga group and the control group, respectively.

The study shows the participants' average heart rate before the yoga session was 76.64 bpm, while it developed to 68.45 bpm after the 12-week yoga course (Table 4). This level of variability is significant, a decrease of 8.19 bpm from its starting value, which indicates the body's substantial reaction to the practice of yoga. Hence, the difference between the measurements before and the measurements after was still quite close, meaning the data was relatively controlled. Consequently, the statistic that the paired t-test generated for the current study was 39.93, and it was supported by a p-value of approximately 2.95×10^{-13}, which seemed to be far below the standard alpha level of 0.05 leveled for making significant inferences. This highly significant value means that the decrease in the average pulse rate after the end of the yoga training is statistically reliable. Also, the Pearson coefficient of 0.97 between the pre- and post-measures indicates a consistent trend across participants.

The results revealed significant reductions in heart rate (-15.53%) and blood pressure (SBP by -6.12% and DBP by -13.25%) in the yoga group compared to the control group (-4.43% HR, +1.84% SBP, and -2.13% DBP, all $p < 0.001$), alongside improvements in perceived stress and anxiety levels.

Table 4: t-Test: Paired Two Sample for Means of Heart rate before and after for Yoga Group.

	Before	After
Mean	76.6416667	68.44583
Variance	8.73958333	8.572254
Observations	12	12
Pearson Correlation	0.97083627	
Hypothesized Mean Difference	0	

Degree of freedom	11
t Stat	39.9257612
P(T<=t) one-tail	<0.001
t Critical one-tail	1.79588482

Whereas, the comparable reduction in the average heart rate from 78.24 bpm before to 77.42 bpm after the 12 weeks was recorded among the control group that had not undergone the yoga intercession (Table 5). This reduction of only 0.82 bpm is approximately less than that of the yoga group. The results of the paired t-test also showed statistical significance with t = 6.09, P = 7.83×10^{-5} (two-tailed). Although this also means there was a change, it was not of the same scale as was expected. This could be because of changes in the natural order from time to time or slight alterations in the lifestyle, which are not accounted for in the study.

Table 5: t-Test: Paired Two Sample for Means of Heart rate before and after for Control Group.

	Before	After
Mean	78.24375	77.42291667
Variance	3.329446023	2.414142992
Observations	12	12
Pearson Correlation	0.974509687	
Hypothesized Mean Difference	0	
Degree of freedom	11	
t Stat	6.090900601	
P(T<=t) one-tail	<0.001	
t Critical one-tail	1.795884819	

DISCUSSION

In the present study, we found that a 12-week yoga therapy, Sahaja Yoga significantly reduced heart rate (HR), systolic blood pressure (SBP), and diastolic blood pressure (DBP). HR and BP are influenced by input from both the parasympathetic and the sympathetic systems.[9] In addition to the proposed mechanism of yoga's ability to attenuate the derangement of the autonomic nervous system, its effect on BP may be beneficial as well. Previous studies of yoga treatment in hypertensive patients have demonstrated a mean reduction of SBP and DBP of 10–15 mmHg.[10, 11]

The rate pressure product (RPP), an indicator of myocardial oxygen consumption and load on the heart, was significantly reduced (20.73% in the yoga group and 6.19% in the standard medical therapy group), showing yoga's beneficial effect on reducing cardiac workload in heart failure patients.[12] Evidence also suggests that yoga can positively influence cardiac autonomic regulation. Since many yoga practices involve altered respiration, variations in training type, instructions, and respiration rates may contribute to differences in Heart Rate Variability measures. Both experimental and cohort studies have reported vagal dominance in time and frequency domains during and after yoga practices, including meditation, relaxation, breathing, and integrated practices.[13]Although the precise mechanism by which yoga influences autonomic activity is not fully understood, certain yoga practices may directly stimulate the vagus nerve, enhancing parasympathetic output[14] and leading to improved cardiac function, mood, and energy states, as well as better neuroendocrine, metabolic, cognitive, and immune responses.[15]

Different types of yoga may influence acute psychological and physiological outcomes. For example, Kuppusamy et al. studied the effects of Bhramari pranayama among healthy adolescents and found significant improvement in HRV parameters toward parasympathetic dominance after six months of regular practice.[16] Similarly, Krishna et al. showed that heart failure patients undergoing yoga therapy in addition to standard medical treatment experienced a significant reduction in HR, BP, and RPP compared to the control group. Tyagi and Cohen also suggested that yoga may enhance cardiac autonomic regulation, with regular practitioners exhibiting increased vagal tone at rest compared to non-practitioners.

However, due to budgetary and time constraints, this study could not employ more advanced methods to assess physiological indicators. Future investigations with larger sample sizes, longer observation periods, and more sophisticated measurements are warranted to better evaluate the long-term effects and underlying mechanisms of yoga practice. Globally, yoga practices are flourishing. Among medical students, who often face high academic stress and related health issues, yoga emerges as an effective means to promote both mental and physical well-being. This study adds to the growing evidence supporting yoga as a viable intervention to improve physiological and psychological health in this population.

CONCLUSION

Based on the findings of this study, it can be concluded that a specific 12-week yoga and meditation program significantly improved heart rate, systolic blood pressure, and diastolic blood pressure among undergraduate medical students. Participants practicing Sahaja yoga demonstrated greater reductions in physiological stress indicators compared to those

in the control group. Sahaja yoga is a unique method of meditation based on an experience called "self-realization," which has effects on mental well-being [17, 18]. Sahaja Yoga can be applied as a daily method to reduce anxiety among students. These findings underscore the importance of considering yoga as a natural and effective approach for managing stress and promoting cardiovascular health among students. Therefore, educational institutions should incorporate yoga and mindfulness practices into student welfare programs.

Conflict of Interest; none

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