Research Article

Effectiveness of integrated yoga as a wellness strategy for a positive impact on psychological and physiological parameters in healthy healthcare students: An interventional study

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ABSTRACT

Introduction: Mental health along with physical health play a pivotal role in individuals' quality of life and overall well-being. Healthcare students are particularly at risk of high stress and anxiety. Integrated yoga is a combination of physical postures (asanas), breathing exercises (pranayama), and meditation (dhyana) and has emerged as one of the most popular ways to maintain a healthy life with beneficial effects on physiological and psychological functions.

Aims: The present study was designed to assess the effect of integrated yoga as a wellness strategy on psychological parameters like depression, stress and anxiety scores (DASS-21), WHO-5 well-being index score and physiological parameters like pulse rate (PR), systolic blood pressure (SBP), diastolic blood pressure (DBP) and body mass index (BMI) among healthcare students.

Materials and Methods: This interventional study was carried out on 84 apparently healthy volunteers with 43 subjects in intervention group and 41 students in control group. DASS 21 scores, WHO-5 well-being scores , PR, SBP,DBP and BMI were recorded at baseline and after 20 weeks of integrated yoga practice. Paired samples t-tests were conducted to evaluate the changes within each group and p-value <0.05 was considered statistically significant.

Results: Statistically significant improvement in DASS 21 scores, WHO-5 well-being scores and decrease in PR, SBP,DBP and BMI were found in intervention group ($p<0.001$). In contrast, control group showed slight deterioration in the above-mentioned parameters ($p<0.05$) at the end of 20 weeks.

Conclusions: Integrated yoga improved the psychological and physiological well-being among healthcare students and so students should be encouraged to incorporate this wellness strategy to reap the long-lasting benefits of yoga.

Keywords: Integrated yoga and psychological and physiological parameters

1. INTRODUCTION

Increased stress, depression and anxiety are the features of modern lifestyle [1]. Mental health along with physical health play a pivotal role in individuals' quality of life and overall well-being. Three leading mental health afflictions worldwide are depression, anxiety, and stress, and hhealthcare students are particularly at risk of high stress and anxiety due to intense academic competition, excessive demands on coping abilities, and a highly competitive and continuously demanding environment which have profound implications on individuals' well-being [2, 3, 4]. In recent times, the mental health needs of healthcare students have received more attention and non-pharmacological treatment modalities like yoga have gained widespread acceptance to tackle this issue [1]. Yoga is an ancient Indian mind-body technique which is defined as the samatvam (balance, homeostasis) at both mind and body levels [5]. Integrated Yoga

is a combination of physical postures (asanas), breathing exercises (pranayama), and meditation (dhyana). Recently, yoga has emerged as one of the most popular ways to maintain a healthy life with beneficial effects on physiological and psychological functions in a variety of clinical and non-clinical conditions [6, 7]. In the past, though several studies have reported the positive effects of yoga on stress reduction in the healthy adult population [4], the effect of integrated yoga on psychological parameters and physiological parameters of healthy healthcare students is scarcely evaluated. Hence the present study was conducted to investigate the effect of integrated yoga on psychological and physiological parameters among healthy healthcare students**.**

2. Materials and Methods

This was an interventional study carried out on 84 apparently healthy, yoga naive volunteers at Yoga and Meditation Centre, Sri Venkateswara Institute of Medical Sciences, Tirupati, Andhra Pradesh, India, after obtaining institutional research and ethics committee approvals (IEC no.1396). A written informed consent was obtained from all the participants at the beginning of the study. The sample size was calculated using an R package namely 'pwr' with 80% power, effect size of 0.8 and alpha level of 0.01 resulting in a total sample size of 76 with 38 each in intervention group and control group [8].

Healthy healthcare students were selected from a pool of healthcare students studying at Sri Venkateswara Institute of Medical Sciences, Tiupati, where the study was carried out using convenience sampling. A brief history about any pre-existing chronic diseases like diabetes mellitus, hypertension, bronchial asthma and thyroid disorders was taken and examination was carried out looking for common health ailments. Subjects who were not willing to participate, physically challenged or who were unable to perform yoga, subjects with contraindications to physical exercises, on weight reduction programs, regularly practising yoga or other forms of exercises and those suffering from chronic illness were excluded from the study.

2.1 Intervention Program:

The study participants of the interventional group underwent one week of integrated yoga training by a certified yoga teacher. The training sessions included a brief lecture about the beneficial effects of asanas, pranayama and meditation followed by performance of the same under the guidance of the certified teacher. The components of the integrated yoga protocol used in the study are given in the table below (Table 1) [9, 10, 11]. After one week of training, the subjects were asked to attend the sessions for 3 days in a week at the centre and practise at home for the remaining 4 days for a period of 20 weeks. The study participants were required to maintain a diary with details of home practice sessions which was regularly checked during the contact sessions at the centre. The participants were also encouraged to incorporate this positive lifestyle change even after the completion of the study so as to reap the long-lasting benefits of yoga. The compliance of the subjects was ensured through repeated telephonic calls, mobile based messages, constant motivation and regular supervision. All the participants in the intervention group practised integrated yoga at least 6 days a week for 20 weeks.

Table 1: Components of integrated yoga protocol

Name of practices	Duration
Asanas-Vaidika Suryanamaskara- 9 steps, Trikonasana, Veerabhadrasana, Vajrasana, Simhasana, Paschimottasana, Purvottasana, Padmasana, Bhujangasana, Shalabasana, Dhanurasana, Sarvangasana, Halasana, Matsyasana, Shavasana	30 min
Pranayama- Ujjayi, Nadishuddhi, Bhramari	15 min
Meditation- Pranavadhyanam, Vipassana meditation	15 min

2.2 Psychological assessment:

Psychological assessment was done using two measures namely the Depression Anxiety and Stress scale (DASS-21) and the World Health organization-5 (WHO-5) well being index scale. All the study participants were asked to fill the questionnaires at baseline and at the end of 20 weeks period. The participants were explained about the questionnaires and were asked to circle one response which reflects their feeling the best. They were also assured of confidentiality and were motivated to think carefully and to be honest.

Assessment of depression, anxiety and stress: DASS-21 has 21 items and this scale has been used in previous studies on the Indian population for assessing the psychological status of study groups [12, 13]. Question numbers 3, 5, 10, 13, 16, 17, and 21 consisted of the depression subscale domain. The question numbers 2, 4, 7, 9, 15, 19, 20 represented anxiety subscale domain, and 1, 6, 8, 11, 12, 14, 18 presented stress subscale domain. It assessed emotional states of depression, anxiety, and stress by questionnaires with each of the three DASS-21 scales classified with a score in normal, mild, moderate, severe, and extremely severe ranges [14] (supplementary file 1).

2.3 Assessment of subjective-well-being: WHO-5 well-being scale, which has adequate validity as a screening tool for depression and as a scale for well-being across a wide range of study fields, was used to assess the subjective well-being of the respondents (supplementary file 2). The WHO-5 questionnaire consisted of 5 simple and non-invasive questions . Each of the 5 items was scored from 5 (all of the time) to 0 (none of the time). The score therefore ranges from 0 (absence of well-being) to 25 (maximal well-being) [15].

2.4 Physiological parameters assessed: Pulse rate, systolic blood pressure (SBP), diastolic blood pressure (DBP) and body mass index (BMI) of all the study participants were measured at baseline and at the end of 20 weeks period. Pulse rate and arterial blood pressure were measured after making the subject to sit quietly for 10 min using omron device. Three consecutive readings with 5 min interval between readings were recorded and the average was taken. Pulse rate was recorded in beats per minute, systolic and diastolic blood pressures were recorded in mmHg. Height and weight of each subject were measured and BMI was calculated using the formula weight in kg divided by square of height in meter (BMI= kg/m^2).

2.5 Statistical Analysis:

The data was systematically collected on multiple variables, including the DASS 21 scores, the WHO 5 well-being index scores, PR, SBP, DBP, and BMI using a predefined proforma initially and transcribed into Microsoft Excel spreadsheets. To ensure the integrity of the analysis, a normality test was performed using the Shapiro-Wilk test, revealing that all variables met the assumption of normality (p-value > 0.05). The results were presented as mean±standard deviation (SD) and the differences between pre and post 20 week values in each group were tested for significance using paired samples t-test. The results were evaluated with an alpha level set at 0.05, and any p-value below this threshold was considered statistically significant. Inter-group comparisons were made using independent samples t-test. All the statistical analyses were performed using IBM SPSS statistics software (version 19.0).

3. Results:

Eighty Four healthy, yoga naive students gave their consent to participate in the study out of which 43 students were willing to practise integrated yoga for a period of 20 weeks and they formed the intervention group of the study and remaining 41 students formed the control group of the study. The study participants included 28 female and 15 male students in intervention group with a mean age of 22.12 ± 3.14 (mean ± SD) and 24 female and 17 male students in control group with a mean age of 22.56±2.12 (mean ± SD).

3.1 Intra-group differences:

Table 2 shows the differences in baseline and post 20 week DASS-21, WHO 5 well-being scores, pulse rate (PR), systolic blood pressure (SBP), diastolic blood pressure (DBP) and body mass index (BMI) values in the intervention group and control group.

The practice of integrated yoga for 20 weeks resulted in significant reduction in DASS-21 scores and improvement in WHO 5 well-being scores in the intervention group ($p<0.001$). Physiological parameters such as pulse rate, SBP, DBP and BMI also decreased significantly post-intervention as compared to baseline values ($p<0.001$) as shown in table 2.

For the control group there was an increase in depression, anxiety and stress scores, decrease in

WHO-5 well-being scores and increase in pulse rate, SBP, DBP and BMI as shown in table 2.

Table 2: Comparison of pre and post 20 week values of DASS 21 scores, WHO 5 well being scores, PR, SBP, DBP and BMI for intervention and control groups

Intervention group- (n=43)						Control group- (n=41)			
Parameters	Timeline	Mean ±SD	Correlation	t-test	p value	Mean ±SD	Correlation	t-test	p value
Depression	Pre	6.21±1.58	0.622	12.911	<0.001	5.17±1.50	0.801	-3.846	<0.001
	Post	3.77±0.92				5.72±1.30			
Anxiety	Pre	5.44±1.28	0.388	11.383	<0.001	5.32±1.12	0.833	-3.777	0.001
	Post	3.33±0.81				5.7±1.04			
Stress	Pre	5.84±1.43	0.716	10.669	<0.001	5.9±1.28	0.866	-2.717	0.01
	Post	4.21±1.08				6.17±1.08			
WHO 5 score	Pre	17.81±1.42	0.604	-3.338	<0.001	17.73±1.41	0.672	3.984	<0.001
	Post	20.7±1.71				17.05±1.18			
Pulse rate (beats/min)	Pre	92.23±9.75	0.794	6.532	<0.001	89.52±7.66	0.981	-3.287	0.002
	Post	85.95±9.87				90.32±7.97			
SBP (mmHg)	Pre	114.17±10.97	0.899	7.984	<0.001	112.32±10.49	0.978	-3.369	0.002
	Post	108.33±9.63				113.5±10.08			
DBP (mmHg)	Pre	70.91±8.52	0.755	5.225	<0.001	72.75±8.35	0.982	-4.069	<0.001
	Post	66.33±7.81				73.77±8.33			
BMI (kg/m^2)	Pre	22.07±3.69	0.963	7.002	<0.001	23.11±2.66	0.987	-5.18	<0.001
	Post	20.95±3.23				23.46±2.66			

3.2 Inter-group differences:

Inter-group analysis demonstrated improvement in all parameters in the intervention group and no such improvement in control group. Comparisons of changes in all parameters in intervention & control group are listed in table 3.

Table 3: Inter-group comparison for all the parameters

Parameters	Group	Mean±SD	t test	p value
Depression	Control	0.55±0.90	12.478	<0.001
	Intervention	-2.44±1.24	12.618	<0.001
Anxiety	Control	0.37±0.63	11.572	<0.001
	Intervention	-2.12±1.22	11.821	<0.001
Stress	Control	0.27±0.64	10.235	<0.001
	Intervention	-1.63±1.00	10.393	<0.001
WHO 5 scores	Control	-0.67±1.07	-12.827	<0.001
	Intervention	2.88±1.42	-12.96	<0.001
Pulse Rate (beats/min)	Control	0.8±1.54	6.911	<0.001
	Intervention	-6.28±6.30	7.139	<0.001
SBP (mmHg)	Control	1.17±2.21	8.452	<0.001
	Intervention	-5.86±4.81	8.657	<0.001
DBP (mmHg)	Control	1.02±1.59	5.956	<0.001
	Intervention	-4.58±5.75	6.145	<0.001
BMI (kg/m^2)	Control	0.34±0.42	8.903	<0.001
	Intervention	-1.13±0.97	9.128	<0.001

4. Discussion: The present study showed an improvement in depression, anxiety and stress scores and WHO-5 well-being index score and also improvement in physiological parameters namely pulse rate, systolic blood pressure, diastolic blood pressure and BMI after 20 week integrated yoga practice among healthy healthcare students.

The study findings are in concurrence with findings of previous studies which have demonstrated the role of yogic practices in improving physiological and psychological functions [14, 16, 17]. One of the studies which investigated the effect of 10 week yoga on the levels of stress, depression, and anxiety among medicine students of the University of Pecs, Hungary, found yoga intervention to significantly reduce depression, anxiety and stress levels [4]. Another study found yoga (4 week-3times/week) to have an effective role in reducing stress, anxiety and depression among a cohort of women [1]. Stress ameliorating effects of yoga have been elucidated in studies on individuals suffering from distress due to natural calamities and also in patients suffering from COVID-19 [14, 18]. Increasing the use of yoga and meditation can provide help to healthcare workers in achieving stable psycho-physical well-being that enhances their value within their work environment [19].

The possible mechanisms involved could be the modulation of autonomic nervous system which buffers the increased activity of sympathetic nervous system and enhances the activity of parasympathetic nervous system leading to increase in the vagus nerve activity [14, 18]. This plays a role in stabilizing the activity of amygdala which is important to regulate emotions and fear responses. Also, yogic practice is found to increase release of neurotransmitters namely serotonin and gamma- aminobutyric acid

(GABA) which stabilize the mood and so is responsible for improved psychological scores [14, 20].

There was also significant decrease in pulse rate, systolic blood pressure, diastolic blood pressure and body mass index after 20 week integrated yoga practice. Improved physiological parameters after practising yoga for varied duration have been demonstrated in earlier studies as well.

A study conducted on 100 adults in Kerala showed improved psychological scores and physical health parameters like blood pressure, blood glucose, cholesterol and also joint pains after a period of 6 months of yoga practice [21]. A 6 day yoga intervention program reduced body mass index, waist and hip circumferences, total cholesterol levels in a study conducted on a single group of 47 subjects [22]. An experimental study with two groups, which was conducted on 40 female participants showed that 6 weeks yoga therapy significantly reduced blood pressure and pulse rate among women aged 30-45 years of age [23]. A positive effect on pulse rate, systolic and diastolic blood pressure was found among yoga practitioners in a study conducted to examine the effect of yoga on cardiovascular function in subjects above 40 yrs of age [24]. A retrospective study involving 15,550 adults aged 53-57 years, found that regular yoga practice for 4 years or more was associated with attenuated weight gain, especially among people who were overweight [25].

Integrated yoga includes pranayama which involves slow and deep breathing. This causes a generalized decrease in the excitatory pathways regulating respiratory and cardiovascular systems. Slow and deep breathing also stimulates pulmonary stretch receptors leading to withdrawal of sympathetic tone in skeletal muscle blood vessels causing vasodilatation and decrease in peripheral resistance which in turn decreases diastolic blood pressure [26, 27]. The focus on the act of breathing is known to pave way for synchronization of neural elements and a stress free state of mind in which parasympathetic activity overrides sympathetic activity [27, 28]. Due to decreased sympathetic activity, arterial tone and peripheral resistance decrease resulting in lowering diastolic and systolic blood pressure as well as heart rate [27]. In the present study control group showed a mild deterioration of psychological and physiological parameters which underscores the need of adopting a wellness strategy to maintain psycho-physical well-being of healthcare students.

Though the above-mentioned studies have determined the effect of different forms of yoga practice for varying periods on psychological and physiological parameters among different groups of subjects, the present study has specifically assessed the effect of integrated yoga practice of 20 weeks on psychological and physiological parameters among healthy healthcare students. This reasonably longer duration of intervention helped in getting consistent and reliable results. The present study has a control group which enhances the strength of conclusions about the intervention's impact. The limitation of the study is the absence of measurement of stress biomarker levels which could have made our study more comprehensive. Further studies are required to assess the correlation between questionnaire response and stress biomarker levels.

5. Conclusions:

In the present study, practice of integrated yoga was found to have a positive impact on the psychological well-being and physiological parameters among healthcare students. Therefore universities can provide a much needed wellness strategy to the healthcare students by promoting practice of integrated yoga. This positive lifestyle change, by way of having a favourable impact on psychological and physical health, can have a positive effect on their academic performance as well. This change will make them better equipped to handle stress associated with the profession and minimize its ill-effects on physical health.

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Conflict of interest : Nil

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