Stress and the impact of stressful events are lesser among raja yoga meditators – A cross sectional study during COVID-19 pandemic from India

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ABSTRACT

This research work presents a study on the relationship between stress & related events with meditation practice and other socio-demographic variables during COVID 19 pandemic among healthy adults. In this cross-sectional survey design, healthy adults with and without practice of Raja yoga meditation completed stress, anxiety & depression related questions (Depression Anxiety & stress Scale, DASS 21) and its impact (Impact of Event Scale-Revised, IES-R) along with other socio-demographic including COVID infection or contact related information. Data was assessed for difference in DASS 21 scores and IES-R scores between Raja yoga meditators (n = 802) & non-meditators (n = 357). An analysis was performed to study the predictors of DASS 21 and IES-R scores. We conclude that healthy Raja yoga meditation practitioners differ from non-meditators in terms of stress/anxiety/depression and its impact during COVID 19 pandemic and meditation practice predicts mental health better along with other sociodemographic variables.

Introduction

Stress is a dynamic concept that involves interaction with multiple factors. Globally, the COVID-19 pandemic has subjected the entire humanity to an unprecedented stress. Sudden enforcement of lockdown, widespread infodemic in media, lack of adequate medical facilities, loss of near and dear ones, etc. had contributed to stresses not only in India [1] but all over the world [2,3]. Earlier studies also had reported increased post-traumatic stress disorder (PTSD) after natural calamities (like earth quake) and epidemic/-pandemic, including [4,5]. Recent large-scale surveys had shown greater amount of stress, anxiety & depression among general public, especially among younger population [6].

COVID-19 and mental health

Individuals having mood disorders are more susceptible to COVID-19 events and fatalities [7]. These findings point to the need to prioritize the COVID-19 vaccination by classifying people with mental disorders as an at-risk population for COVID-19 hospitalization and mortality. As part of the post-COVID-19 syndrome, depressive symptoms and clinically severe depression were often reported by people [8]. Priority study areas should include the overlap of depressive symptoms in people with post-COVID-19 syndrome and their distinction from manifestations of long COVID syndrome. A systematic review provided the overview of PTSD, depression and other psychological distress symptoms in general population during COVID-19 [9]. In the majority of investigations, unfavorable psychiatric symptoms were shown to be highly prevalent among many countries. The study stressed upon the prevention of mental illnesses to be the top priority. A cross-sectional study with proposed chain mediation model compared the psychological states of general population in Asia, Europe, and North America and established correlation between COVID-19 symptoms and adverse mental health outcomes [10,11]. The findings revealed that Vietnam had the lowest mean scores in these categories, while Poland and the Philippines had the greatest levels of stress, despair, and anxiety. The desire for health information and the pandemic's perceived impact were mediators between the COVID-19 symptoms and the ensuing mental health condition. A similar study sought to examine the disparities across seven Asian MICs and

the impact of the pandemic on physical and mental health [12]. The highest psychological distress was reported by Thai respondents, while lowest levels were reported by Vietnamese respondents. The psychological effects of partial lockdown on the general population in Vietnam were lower as compared to the similar studies in China, Iran and Italy [13]. Marital status, employment status, level of education, size of the family, and contact history with COVID patients were the stressors among this population. But the pandemic impacted quality of life and economic well-being of Vietnamese population [14]. The family income of near about 66.9 percent of these people was reduced during COVID-19. Presence of physical illness, female gender, and number of family members were the factors affecting quality of life among these people. A cross-country study compared the psychological health of Chinese respondents (encouraging face masks during initial COVID-19 stage) with that of Polish residents (that did not encourage the use of face masks) [10,11]. The results showed that the Polish respondents had higher levels of stress, anxiety and depression, possibly because of larger number of COVID cases in Poland as compared to China.

The implementation of strict policies by some governments to restrict the spread of COVID-19 benefitted the mental health of their population [15]. The findings highlight the need to devise interventions for mental health care of vulnerable population.

Role of yoga and meditation

To cope with the mounting stress imposed by pandemic, people have tried different coping strategies which included exercise, connecting with family & friends, reduced screen time, reading, playing indoor games, healthy diet, smoking, alcohol and drugs [16]. Apart from regular coping strategies, many have tried mind–body practices like yoga and meditation to overcome the stress and improve immunity. The Ministry of AYUSH, Government of India released guidelines for yoga practice and other complementary therapies like Ayurveda as a preventive and add-on therapeutic measures for general public during COVID-19 pandemic [17]. A recent pan India survey involving around 10,000 subjects reported that people who practiced yoga were engaged more with healthy and enduring lifestyle than non-yoga practitioners during COVID-19 pandemic [16]. Earlier studies had also shown increased resilience following yoga/meditation practices [18]. Another recent study also had shown engineering students who practiced yoga during COVID-19 differed in behaviors (healthy) compared to students who did not practice yoga (Beddoes and Danowitz, 2021). These findings suggest that people who are engaged with complementary mind–body practices like yoga, meditation, etc. find comfort and solace during times of distress and uncertainty like the COVID-19 pandemic. Previous studies had shown reduction in perceived stress, anxiety and depression with yoga/meditation practices both in healthy and clinical population [19].

Raja yoga meditation and its role in coping with distress

Raja yoga meditation is a behavioral intervention that aims to empower the mind and thought system of the practitioners [20]. The purpose of this meditation is to encourage the positive flow of thoughts and experience peace through the knowledge of self and the Supreme. Various research studies have proved the physiological, psychological and neural effects of this meditation on regular practitioners. Even short-term Raja yoga meditation intervention may result in decreased stress and anxiety symptoms. A group of patients suffering from anxiety and depression indicated considerable improvement following six weeks of intervention [21]. Another study was conducted observe the effect of Raja yoga meditation on stress, anxiety and depression in women with

premenstrual syndrome [22]. Raja yoga was found to be useful in alleviating depression in PMS-affected women. In patients having major heart surgery, the practice of Raja yoga meditation helped to reduce anxiety and cortisol levels [23]. Raja yoga meditation also affected the psychosomatic components of hypertension patients [24]. This meditation intervention helped in lowering hypertension, and also improved general health by reducing psychosomatic symptoms of disease and medication dosages. The EEG recordings of experienced Raj yoga meditators showed that this meditation resulted in a decrease in delta activity and an increase in low alpha activity [25]. The brain areas that demonstrated altered activations relate to attention and cognitive abilities.

The Brahma Kumaris World Spiritual University teaches Raj Yoga meditation, which differs from other meditation approaches in its ideas and practice. It is a globally recognized non-governmental organization (NGO) associated with the United Nations Department of Public Relations [26]. It is the largest spiritual organization led by women. It uses Raja yoga meditation to enable individuals of all religions and cultural backgrounds recognize and feel their inner self and bring positive transformation to their life. The teachings here are accessible to all for free of cost.

With this background, we hypothesized that 1) people practicing regular meditation will have reduced stress/anxiety/depression and also reduced impact of stress & related events during COVID-19 pandemic compared to non-meditators. 2) Status of meditation practice (meditation practitioner or non-meditation practitioner) and COVID infection history will predict the levels of stress/anxiety/depression and the impact of stress and related events during COVID-19 pandemic.

Methodology

Setting & subjects

The study was conducted as an online cross-sectional survey using google forms between Jan 2021 to April 2021. It was a collaborative study between CSIO-CSIR, Chandigarh, India and SpARC wing of Brahma Kumaris, Mount Abu, India. The study was approved by the institutional ethical committee of CSIO-CSIR, Chandigarh (Ref: IEC/CSIO/2020 Project No. 27 dated 22nd Sep 2020). All the subjects had given their informed consent electronically and only consenting subjects were recruited based on their voluntary participation.

The Brahma Kumaris is a global network of organisations with 8,500 established centers in over 130 countries and 900,000 regular students that provides free of cost life time meditation training and programs. The availability of large number of meditation practitioners, low-cost sampling strategy and accessibility during COVID-19 lockdown were the reasons for choosing this particular group for sampling.

The study subjects included both meditators and non-meditators. Subjects with meditation experience were recruited through the SpARC wing of Brahma Kumaris through its nationwide contacts. Inclusion criteria for meditators were a) practicing Brahma Kumaris Raja yoga meditation regularly (at least 3 days a week, 45–60 mins a day) for at least 1-year b) aged between 18 and 60 years c) either sex d) ability to read and understand English/Hindi. Non-meditators were recruited by researchers at CSIO-CSIR, Chandigarh through their acquaintances. The inclusion criteria for non-meditators were same as that of meditators except for the meditation criteria. In both the groups, subjects with diagnosed mental illness were excluded. Subjects who practiced any form of yoga/meditation were excluded from non-meditators group.

Study procedure

All the participants were invited to participate via email or social-media invitation. Assessment scales for stress, anxiety and depression and impact of stressful events were circulated through google form for the willing and consenting subjects in English. The form was sent for language editing and verification for translation and back translation. Firstly, two language experts translated the scale into Hindi, Navneet Anand, language officer, CSIR-CSIO, Chandigarh and Shally Dhawan, language officer, BSNL, Chandigarh. As a consequence, the scale's versions 1 and 2 were created. Each item of these versions was discussed with the subject expert, Dr. Imran Noorani, clinical psychologist resulting in version 3 of the bilingual form. This version was then back translated into English by Dr. Kamna Singh, faculty, Department of English, S.D. College, Chandigarh resulting in version 4 of the scale. After that, this version was compared to the original scale, and any discrepancies were reviewed with the subject expert again. This led to fifth version of the scale. This scale was applied to 40 Rajyoga meditators in Chandigarh to determine how simple it was to comprehend. They were encouraged to indicate the difficulties they were facing in comprehending the items of the scale. Depending on the feedback from the participants, the issues were again discussed with the language and subject expert and efforts were made to keep the language understandable. This final version of the scale has been provided in Appendix A. The survey form was open for all.

All the data including socio-demographic details of the participants were pooled in an excel sheet.

Assessments

Socio-demographic details

Socio-demographic details were collected through structured questionnaire which included age, sex, marital status, employment status and locality. Details about the symptoms of COVID-19 infection, contacts with COVID-19 patients and travel history were also collected from both meditators and non-meditators. Years of experience in Brahma Kumaris Raja yoga meditation was also obtained from meditators.

Mental health assessments

Stress, anxiety and depression was assessed by DASS-21 [27]. It is a self-report scale assessing the emotional states of stress, anxiety and depression with 7 items for each of them. Scores are given on a Likert scale of 0–3 (0- least and 3-most). Dysphoria, despair, devaluation of life, self-deprecation, lack of interest, anhedonia, and lethargy are all assessed on the depression scale. Autonomic arousal, skeletal muscle effects, situational anxiety, and subjective sensation of anxious affect are all measured on the anxiety scale. The stress scale is sensitive to non-specific arousal levels that have been present for a long time. It evaluates restlessness, anxious arousal, and being easily disturbed / agitated, irritable / overreactive, and impatient. Summing the scores for the relevant elements yields depression, anxiety, and stress scores.

Impact of distress caused by stressful events (like COVID-19) was assessed by Impact of Event Scale-revised (IES-R) [28]. It is a 22 item self-report scale assessing subjective stress following stressful life events. The amount of subjective distress caused by events are scored on a 5-point Likert scale (0-4, 0- not at all affected; 4- extremely affected). The three subscales of IES-R are: 1) Intrusion: 8 items measuring intrusive symptoms such as invasive thoughts, nightmares, intrusive feelings and visions, 2) Avoidance: 8 items measuring avoidance symptoms such as avoidance of feelings, circumstances, and thoughts, as well as numbing of receptivity and 3) Hyperarousal: 6 items measuring hyperarousal symptoms such as anger, impatience, hypervigilance, trouble in

concentrating and intensified startle. The IES-R includes questions to assess a patient's level of distress in reaction to trauma. For example, question number 6 assessing intrusion reads as "I thought about it when I didn't mean to", question number 11 measuring avoidance symptoms reads as "I tried not to think about it", and question number 18 attempting to assess hyperarousal symptoms reads as "I had trouble concentrating". Each of the three DASS-21 scales contains 7 items, divided into subscales with similar content. The depression scale assesses dysphoria, hopelessness, devaluation of life, self-deprecation, lack of interest / involvement, anhedonia and inertia. The anxiety scale assesses autonomic arousal, skeletal muscle effects, situational anxiety, and subjective experience of anxious affect. The stress scale is sensitive to levels of chronic non-specific arousal. It assesses difficulty relaxing, nervous arousal, and being easily upset / agitated, irritable / overreactive and impatient. Scores for depression, anxiety and stress are calculated by summing the scores for the relevant items.

Validation of DASS-21 and IES-R during COVID-19

The psychological impact of COVID-19 was assessed in general population of China using IES-R and the mental health states were assessed using DASS-21 [29]. It was found that more than 50 percent of the participants took the impact of the outbreak as moderate to severe, and about 28 percent of the participants had suffered moderate to severe anxiety symptoms. Physical symptoms, female gender and students suffered higher levels of distress. Staying updated and following COVID norms led to decrease in the levels of psychological turbulence. The mental health parameters of Chinese and Spanish respondents were also compared using DASS-21 and IES-R scales [30]. Chinese respondents exhibited higher levels of psychological impact, while Chinese respondents exhibited higher levels of stress, depression and anxiety. Spanish participants suffered COVID symptoms more and utilized medical services. A similar study compared the psychological health of general population of United States and China using IES-R and DASS-21 [31]. The respondents from America suffered more stress and depression, whereas the respondents from China suffered more PTSD symptoms. The same scales IES-R and DASS were used to compare the psychological states of the residents of Iran and China [32]. The residents of Iran reported higher levels of anxiety and depression, probably due to variations in government responses to the epidemic and access to healthcare services. Both the scales were validated in the study that examined the psychological health of general population in Philippines [33]. Near about one-sixth of respondents experienced moderate-to-severe depression and psychological damage, while one-fourth expressed moderate-to-severe anxiety. Female gender, low level of education, single, and young children were more impacted. Another cross sectional study examined the psychological impact of the pandemic among Vietnamese people using IES-R [13]. During the initial COVID-19 nationwide lockdown, there were comparatively high rates of participants experiencing PTSS. A higher level of psychological discomfort was positively correlated with being female, older than 44, or having more children in the household. Hindi version of IES-R has been validated in Rajyoga meditators in a previous study [34]. Scores on the IES-R and the existence of COVID symptoms were shown to be significantly positively correlated. Consequently, the scale seems to be a reliable indicator of post-trauma occurrences in clinical and research situations.

Data extraction and analysis

Data collected via google form were pooled in an excel sheet. Incomplete responses were removed and the subjects' personal identity were deidentified and the group status were coded by SM. Coded data were analyzed by RG using Jamovi version 2.0 [35].

Meditators and non-meditators were compared for the DASS-21 scores and IES-R scores using *t* test for group differences. Categorical variables were analyzed using chi square test. Multiple linear hierarchical regression was performed with meditation status, VOCID infection history, travel history and other socio-demographic variables as predictors and DASS-21 scores and IES-R scores as dependent variable.

Results and discussion

Response rate

Google forms were circulated to around 2000 subjects through SpARC wing of Brahma Kumaris and acquaintances of researchers. From 2000 contacts, 1162 (58.1%) responses were obtained. Data obtained was screened for completeness and 1159 responses were available for analysis.

Socio-demographic characteristics

Out of 1159 respondents, 802 (69.2%) were meditators (Brahma Kumaris Raja yoga practitioners) and 357 (30.8%) were non-meditators. In the table given below, RY stands for the Raja yoga practitioners, which simply means the subjects that practice the Raja yoga meditation regularly and are having the minimum meditation experience of one year. NRY stands for non-Raja yoga practitioners, meaning the subjects having no prior Raja yoga meditation experience. Raja yoga meditation is a mental exercise that can be practiced anywhere at any time with open eyes. Thus, the frequency of this versatile practice cannot be measured. But group meditation and spiritual lessons are conducted every day by the meditation centers and a record is maintained by the respective centers that include attendance and demographics of the practitioners. Other characteristics of meditators and non-meditators like age (category), sex, marital status, employment status, and COVID infection history/contact history/travel history are given in Table 1. Chi square test of association between meditation status and many other COVID related variables and socio-demographic variables were significant as shown in Table 1.

Psychometric properties of DASS-21 & IES-R

Internal consistency

The IES-R used in the survey form demonstrated excellent internal consistency. The scale resulted in Cronbach's alpha value of 0.91. The three subscales also showed good consistency (intrusion 0.83, hyperarousal 0.81, and avoidance 0.81). The DASS scale used in the survey form also showed excellent consistency (Cronbach's alpha value 0.968).

Correlations

Table 2 shows the Pearson correlation analysis between the subscales of IES-R and DASS-21. All the correlations are statistically significant. All the parameters showed correlated well with each other.

DASS 21 & IES-R scores among meditators and non-meditators:

Data for DASS-21 & IES-R for meditators and non-meditators were tested for group differences irrespective of COVID infection status. Data was tested for normality and found to be non-normal. Median and Interquartile range for DASS-21 are 2 and 7 for meditators and 8 and 25 for non-meditators respectively. For IES-R it was 6 and 13 for meditators and 11 and 31 for non-meditators respectively. Mann Whitney *U* test showed a significant

difference in DASS-21 scores (Mann Whitney U = 98764, P < 0.001) and IES-R scores (Mann Whitney U = 117511, P < 0.001) between meditators and non-meditators (refer Table 3).

Similarly, group differences for DASS-21 & IES-R between subjects with and without COVID infection history irrespective of

Table 1
Socio-demographic characteristics of subjects.

S. No	Variables	Number (percent)	Chi square/Fisher's exact statistic
1	**Meditation Status**		
	RY	802(69.2%)	171***
	NRY	357 (30.8%)	
2	**COVID Infection History**		
	RY		
	Yes	122(10.5%)	
	No	680(58.6%)	0.04
	NRY		
	Yes	56(4.8%)	
	No	301(25.9%)	
3	**COVID Contact History**		
	RY		
	Yes	175(15.1%)	
	No	466(40.2%)	
	Not Sure	161(13.9%)	3.14
	NRY		
	Yes	62(5.3%)	
	No	216(18.6%)	
	Not Sure	79(6.8%)	
4	**Travel history**		
	RY		
	Yes	14(1.2%)	
	No	788(67.9%)	0.006
	NRY		
	Yes	6(0.5%)	
	No	351(30.2%)	
5	**Sex**		
	RY		
	Male	323(27.8%)	
	Female	479(41.3%)	11.5***
	NRY		
	Male	182(15.7%)	
	Female	175(15.1%)	
6	**Age Category**		
	RY		
	18–30 years		
	30–50 years	114(9.8%)	
	>50 years	381(32.8%)	136***
	NRY	307(26.4%)	
	18–30 years	144(12.4%)	
	30–50 years	173(14.9%)	
	>50 years	40(3.4%)	
7	**Employment Status**		
	RY		
	Employed	296(25.5%)	
	Self employed	210(18.1%)	
	Un employed	296(25.5%)	44.7***
	NRY		
	Employed	200(17.2%)	
	Self employed	44(3.7%)	
	Un employed	113(9.7%)	
8	**Marital Status**		
	RY		
	Married	491(42.3%)	
	Unmarried		
	Widow/Widower	232(20%)	
	Divorced	55(4.7%)	
	Separated	12(1%)	
	NRY	12(1%)	N/A***
	Married	144(12.4%)	
	Unmarried	205(17.6%)	
	Widow/Widower	3(0.2%)	
	Divorced	4(0.3%)	
	Separated	1(0.08%)	

Table 2
Correlation between the subscales of IES-R and DASS-R.

Pearson's Correlation	Stress	Anxiety	Depression	Avoidance	Intrusion	Hyperarousal
Stress	1	0.882*	0.882*	0.672*	0.873*	0.874*
Anxiety	0.882*	1	0.863*	0.665*	0.825*	0.839*
Depression	0.882*	0.863*	1	0.656*	0.823*	0.830*
Avoidance	0.673*	0.665*	0.656*	1	0.766*	0.778*
Intrusion	0.842*	0.825*	0.823*	0.766*	1	0.929*
Hyperarousal	0.844*	0.839*	0.830*	0.778*	0.929*	1

* Correlation is significant at 0.01level (two-tailed).

Table 3
Comparison of DASS-21 & IES-R Scores-Mann Whitney U Test.

S.No.	Variables	Category	Median	IQR	Test statistic
1	DASS-21	COVID +	8.0	14.0	59394***
		COVID -	3.0	9.0	
2	IES-R	COVID +	12.0	18.0	65427***
		COVID -	6.0	16.0	
3	DASS-21	RY	2	7	98764***
		NRY	8	25	
4	IES-R	RY	6	13	117511***
		NRY	11	31	

meditation status was also tested with Mann Whitney U test. Median and Interquartile range for DASS-21 are 8 and 14 for subjects with COVID infection history and 3 and 9 for subjects without COVID infection history respectively. For IES-R it was 12 and 18 for subjects with COVID infection history and it was 6 and 16 for subjects without COVID infection history respectively. Mann Whitney U test revealed a significant difference in DASS-21 scores (Mann Whitney U = 59394, P < 0.001) and IES-R scores (Mann Whitney U = 65427, P < 0.001) between subjects with and without COVID infection history irrespective of status of meditation (refer Table 3).

We have also done a subgroup analysis only in either meditators or non-meditators, testing for differences in DASS 21 and IES-R scores between those with and without COVID infection history using Mann Whitney U test. Amongst meditators, the DASS 21 (Mann Whitney U = 27143, P < 0.001) and IES-R scores (Mann Whitney U = 29867, P < 0.001) differed significantly. Amongst non-meditators also, the DASS 21 (Mann Whitney U = 5931, P < 0.001) and IES-R scores (Mann Whitney U = 6580, P < 0.009) differed significantly.

Multiple linear regression analysis:

We performed multiple hierarchical linear regression study the link between stress & related events and its impact with meditation status, COVID related variables and other sociodemographic characteristics. Hierarchical linear regression analysis is a special form of multiple linear regression, in which one or more predictor variables are added to the model in separate steps called as "blocks". It enables one to see whether adding variable(s) at each block improves a model stability to predict the response variable.

In this study, hierarchical multiple linear regression was performed with meditation status (meditator or non-meditator), COVID related variables (infection history, contact history and travel history) and other socio-demographic variables (age category, sex, marital status and employment status) as predictors. Dependent variable was either DASS-21 or IES-R scores.

We tested for eight models sequentially as follows,

Model 1: DASS 21 = a + b (Meditation status)

Model 2: DASS 21 = a + b1 (Meditation status) + b2 (COVID infection history)

Model 3: DASS 21 = a + b1 (Meditation status) + b2 (COVID infection history) + b3 (Age)

Model 4: DASS 21 = a + b1 (Meditation status) + b2 (COVID infection history) + b3 (Age) + b4 (COVID contact history

Model 5: DASS 21 = a + b1 (Meditation status) + b2 (COVID infection history) + b3 (Age) + b4 (COVID contact history + b5 (Travel history)

Model 6: DASS 21 = a + b1 (Meditation status) + b2 (COVID infection history) + b3 (Age) + b4 (COVID contact history + b5 (Travel history) + b6 (Gender)

Model 7: DASS 21 = a + b1 (Meditation status) + b2 (COVID infection history) + b3 (Age) + b4 (COVID contact history + b5 (Travel history) + b6 (Gender) + b7 (Marital status)

Model 8: DASS 21 = a + b1 (Meditation status) + b2 (COVID infection history) + b3 (Age) + b4 (COVID contact history + b5 (Travel history) + b6 (Gender) + b7 (Marital status) + b8 (employment status)

Similarly, eight models were tested for IES-R scores as dependent variable (with the same predictor variables as used for predicting DASS 21) as well.

The change in R^2 was compared for each model and the best model was chosen based on model fitness, estimate of the slope and change in amount of variance explained at each model. Out of the eight models, model 3 with meditation status, COVID infection history and age category predicted the model better than other models with 15% (F = 51.5, P < 0.001) amount of variance for DASS-21 scores and 11.3% (F = 38, P < 0.001) amount of variance for IES-R scores. Meditation status, COVID infection history and Age independently and significantly predicted DASS 21(Meditation status: Beta = -0.63, P < 0.001, reference is non-meditators; COVID infection history: Beta = 0.42, P < 0.001 & reference is no COVID infection history; Age category: Beta = -0.27 for 30–50 years of age & −0.36 for above 50 years of age, P < 0.001 for both categories & reference is 18–30 years of age) and IES-R (Meditation status: Beta = -0.51, P < 0.00, reference is non-meditators; COVID infection history: Beta = 0.341, P < 0.001 & reference is no COVID infection history; Age category: Beta = -0.31 for 30–50 years of age & −0.39 for above 50 years of age, P < 0.001 for both categories & reference is 18–30 years of age).

We arrived at the final model (model 3 with meditation status, COVID infection history and age as predictors for both DASS 21 as well as IES-R as dependent variable) of best fit based on the change

in adjusted R square which was significant at each block of predictor entry. Details of each model including standardized estimate of slope, adjusted R^2, change in adjusted R^2 and model fitness measures are given in Tables 4–6 (for DASS-21 as dependent variable) and Tables 7–9 (for IES-R as dependent variable).

Comparison analysis of psychological and mental health of meditators and non-meditators

The IES-R and DASS scores of non-meditators were high as compared to that of Rajyoga meditators. Figs. 1–3 show the comparison of scores between them. As shown in the figures, the psychological health of the meditators was sound as compared to the general population.

Discussion and future recommendations

The study results show that the presence of COVID infection increases the level of stress scores assessed by DASS 21 and also a higher score on IES-R scale scores. This is in line with the results of previous findings [36–41]. The findings imply that the lockdown brought on by COVID-19 may have led to lower brain hemodynam-

Table 4
Model Fit Measures-DASS-21.

| Model | R | R^2 | Adjusted R^2 | Overall Model Test | | | |
				F	df1	df2	p
1	**0.335**	**0.112**	**0.111**	**146.1**	**1**	**1157**	**< 0.001**
2	**0.369**	**0.136**	**0.134**	**90.9**	**2**	**1156**	**< 0.001**
3	**0.389**	**0.152**	**0.149**	**51.5**	**4**	**1154**	**< 0.001**
4	0.392	0.154	0.150	35.0	6	1152	< 0.001
5	0.394	0.155	0.150	30.2	7	1151	< 0.001
6	0.398	0.158	0.152	27.0	8	1150	< 0.001
7	0.402	0.161	0.152	18.4	12	1146	< 0.001
8	0.404	0.163	0.153	15.9	14	1144	< 0.001

Table 5
Model comparisons-DASS-21.

| Comparison | | | | | | | |
Model		Model	ΔR^2	F	df1	p	df2
1	**–**	**2**	**0.02384**	**31.89**	**1**	**1156**	**< 0.001**
2	**–**	**3**	**0.01563**	**10.63**	**2**	**1154**	**< 0.001**
3	–	4	0.00244	1.66	2	1152	0.190
4	–	5	9.61e-4	1.31	1	1151	0.253
5	–	6	0.00318	4.35	1	1150	0.037
6	–	7	0.00305	1.04	4	1146	0.384
7	–	8	0.00202	1.38	2	1144	0.252

Table 6
Model coefficients – DASS-21.

| Predictor | Estimate | SE | t | p | Stand. Estimate | 95% Confidence Interval | |
						Lower	Upper
Intercept	16.04	0.822	19.52	< 0.001			
Category:							
RY – NRY	−7.98	0.795	−10.05	< 0.001	−0.628	−0.750	−0.505
COVID Infection:							
Present – Absent	5.46	0.958	5.70	< 0.001	0.429	0.282	0.577
Age:							
30–50 – 18–30	−3.40	0.907	−3.76	< 0.001	−0.268	−0.408	−0.128
Above 50 – 18–30	−4.59	1.027	−4.47	< 0.001	−0.361	−0.519	−0.202

Reference levels are "NRY' for Meditation status, "COVID infection absent" for COVID infection history & "18–30 years" for age category. DASS-21-Depression Anxiety & Stress

Table 7
Model Fit Measures-IES-R.

| Model | R | R^2 | Adjusted R^2 | Overall Model Test | | | |
				F	df1	df2	p
1	0.287	0.0822	0.0814	103.6	1	1157	< 0.001
2	0.312	0.0970	0.0955	62.1	2	1156	< 0.001
3	0.341	0.1163	0.1133	38.0	4	1154	< 0.001
4	0.345	0.1190	0.1144	25.9	6	1152	< 0.001
5	0.346	0.1198	0.1145	22.4	7	1151	< 0.001
6	0.350	0.1227	0.1166	20.1	8	1150	< 0.001
7	0.354	0.1250	0.1158	13.6	12	1146	< 0.001
8	0.358	0.1282	0.1175	12.0	14	1144	< 0.001

Table 8
Model comparisons-IES-R.

Comparison							
Model		Model	ΔR^2	F	df1	df2	p
1	**–**	**2**	**0.01487**	**19.033**	**1**	**1156**	**< 0.001**
2	**–**	**3**	**0.01928**	**12.587**	**2**	**1154**	**< 0.001**
3	–	4	0.00270	1.764	2	1152	0.172
4	–	5	8.03e-4	1.050	1	1151	0.306
5	–	6	0.00291	3.810	1	1150	0.051
6	–	7	0.00223	0.731	4	1146	0.571
7	–	8	0.00321	2.109	2	1144	0.122

Table 9
Model coefficients – IES-R.

|						95% Confidence Interval	
Predictor	Estimate	SE	t	p	Stand. Estimate	Lower	Upper
Intercept	22.83	1.13	20.14	< 0.001			
Category:							
RY – NRY	−8.86	1.10	−8.08	< 0.001	−0.515	−0.641	−0.390
COVID Infection:							
Present – Absent	5.87	1.32	4.44	< 0.001	0.341	0.190	0.492
Age:							
30–50 – 18–30	−5.33	1.25	−4.26	< 0.001	−0.310	−0.453	−0.167
Above 50 – 18–30	−6.77	1.42	−4.78	< 0.001	−0.394	−0.555	−0.232

Reference levels are "NRY' for Meditation status, "COVID infection absent" for COVID infection history & "18–30 years" for age category; IES-R-Impact of Events Scale-Revised; RY-Raja yoga; NRY-Non-Raja yoga.
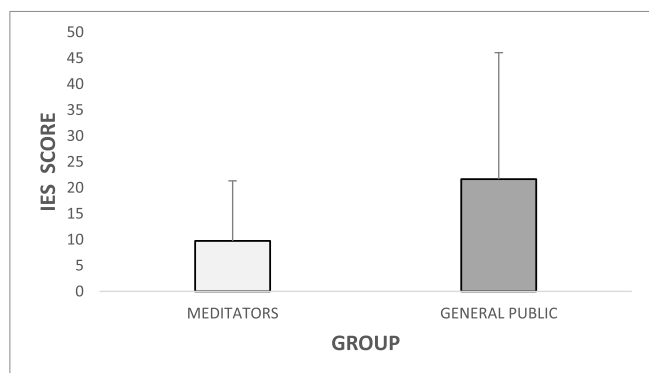
Fig. 1. Comparison of IES-R scores among meditators and non-meditators.
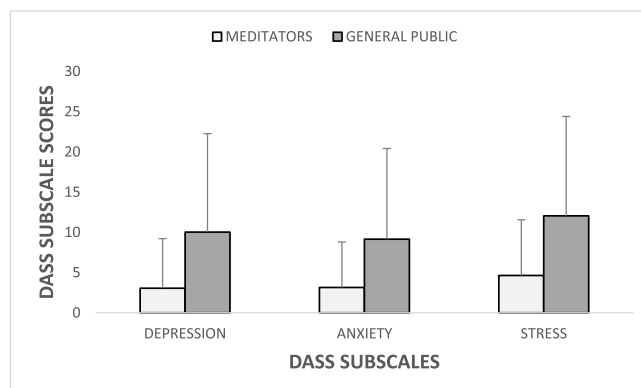
Fig. 3. Comparison of DASS subscale scores among meditators and non-meditators.
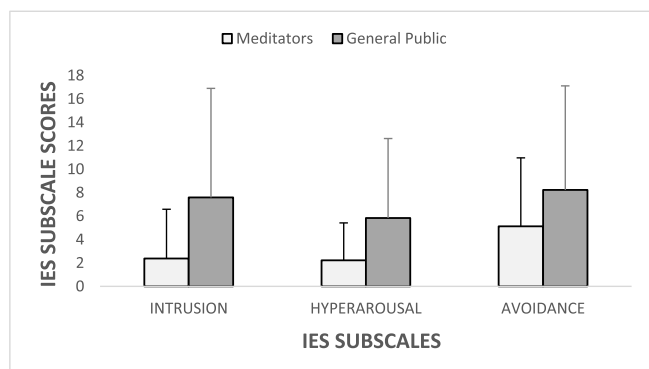
Fig. 2. Comparison of IES-R subscale scores among meditators and non-meditators.

ics, which are further linked to an increased risk of mental health issues including depression or a reduction in cognitive function in mental processes [42]. Urban Green scenery can help to counter-

act the damaging neuropsychological effects of the pandemic. The study emphasizes the possibility of higher psychological stress following COVID-19 when exposed to typical busy urban street views and the opposite significance of exposure to green urban spaces, which may mitigate the risk negatively impacted by that stress, while simultaneously having additional positive effects on the brain. Viewing greenery images and practicing relaxation are the well-known interventions to enhance mental well-being. Some research studies have examined the effects of viewing pictures of greenery on functional imaging. A study compared the brain activity during arithmetic tasks before and after the intervention in order to discover the functional brain alterations underlying seeing pictures of greenery and a brief relaxing technique [43]. Short relaxation exercises dramatically increased the amount of oxygenated hemoglobin during mathematical activities in important regions of the prefrontal cortex.

The interesting findings of the present study are 1) people practicing Raja yoga meditation are likely to have lesser scores on DASS 21 which assesses stress, anxiety and depression and lesser impact

of stressful events assessed by IES-R scale than non-meditators. 2) People aged 18–30 years are likely to have more DASS 21 scores and IES-R scores compared to people aged 30 years and above. This could be because, majority of the working population are youngsters who have the apprehension of getting infected with COVID as they move around, hence possibility of greater stress and its consequences.

Though the study findings are interesting, it needs to be interpreted in the context of the study design. Considering the cross-sectional survey design, no conclusive causal relation can be interpreted between meditation status and stress or related events and their impact with other variables. Moreover, the amount of variance explained by meditation status, COVID infection history and age category in predicting DASS 21(15%) and IES-R scores (11%) is lesser due to greater amount of variability in the data amongst meditators as well as non-meditators, though the three predictors (meditation status, COVID infection history and age category) provided a significant model fit with independently significant slope for both DASS 21 and IES-R scores.

Other possible reason for a smaller amount of variance explained by the predictors could be the significant association between meditation status and many of the socio-demographic variables. As it was a survey design with snow ball sampling strategy, we could not do proper matching of the meditators and non-meditators in socio-demographic variables. As shown in Table 1 many of the socio-demographic variables differed significantly between meditators and non-meditators group. Apart from the differences in socio-demographic characteristics, sample size of non-meditators was only around 50% of the meditators sample size, though the overall sample size was adequate. Perhaps, we faced real challenge in getting response from non-meditators compared to meditators.

Future research can be planned to study if Brahma Kumaris Raja yoga meditation intervention could actually reduce stress and the impact of stress & related events with randomized controlled trials during pandemic conditions like COVID-19. Earlier studies on Brahma Kumaris Raja yoga meditation have shown reduction of stress and related health consequences like tension headache and coronary artery disease [44] and reduction of anxiety and cortisol levels in patients undergoing coronary bypass surgery(U. [23]. In healthy population raja yoga meditators were found to have greater positivity and happiness than matched controls [45]. A recent study has also shown grey matter volume changes in happiness related areas in raja yoga meditators [46]. However, if the same will hold true (Brahma Kumaris Raja yoga meditation as a preventive tool) in the context of uncertainties like the COVID 19 pandemic needs to be further studied in controlled trials. Near infrared technology to measure brain function during Yoga can be used to establish the proven connection between meditation and the neural activations.

Notwithstanding the limitations, the study results highlight the significance of natural subjective comfort provided by mind–body practices like meditation during highly stressful and uncertain conditions like COVID 19 pandemic. It is evident from the greater amount of variance explained by the meditation status in predicting the stress/anxiety/depression scores assessed by DASS 21 and impact of stressful events assessed by IES-.

R scale than the other two significant predictors- COVID infection history and age category. This is corroborated by the findings of another recent large-scale survey on similar lines [16]. Raja yoga meditation which focuses on one's innate inner powers, loveful connection with a supreme being and a greater goodness at a larger context even in adverse situations might facilitate better mental health and this could substantiate our study findings.

Considering the uncertainties and ambiguity in rendering medical care posed by of COVID 19 pandemic, role of mind–body practices like yoga, meditation, physical exercise, etc. needs to be emphasized for its preventive and add-on therapeutic utility through its positive impact on reducing distress. Digital mental health programs which have greater role to play during pandemic like COVID-19 can easily incorporate mind–body interventions like meditation for the betterment of the society at large [47].

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Informed consent

Before the study, all of the participants signed a consent form.

Data and material availability

Upon request, the corresponding author will make the data supporting the results of this study accessible.

Authors' contribution

Shobhika Madhu: Design of study, acquisition of data, analysis and interpretation of data, manuscript drafting and editing. Ramajayam Govindaraj: Design of study, analysis and interpretation of data, manuscript drafting and editing. Prashant Kumar: supervision, analysis and interpretation of data, manuscript reviewing and editing. Sushil Chandra: supervision, analysis and interpretation of data, manuscript reviewing. The final manuscript has been read and accepted by all the authors.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ceh.2022.07.001.

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