



Effect of Yoga-based breathing practices on depression, anxiety, stress, and fear of COVID-19 positive hospitalized patients: A randomized controlled trial

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ABSTRACT

Background: COVID-19 infection has an impact on the mental state of patients and requires attention to mental health care.

Objective: The aim of this study is to assess the effect of Yoga-based breathing practices on the mental state of patients with COVID-19.

Material and methods: A randomized controlled trial was conducted with 63 patients (male=46) who were RT-PCR positive for COVID-19 and hospitalized with asymptomatic (RT-PCR positive but no symptoms), mild (febrile, body ache, pharyngitis, nonproductive cough), and moderate (SpO₂ < 92%) symptoms assigned in the yoga (n=32) and control group (n=31). The study was conducted at Atharva Multispecialty Hospital and Research Center, North India. The yoga group received Yoga-based breathing practices twice a day for ten days in addition to conventional care, and the control group was advised not to do the practice. The Depression Anxiety and Stress scale (DASS-21) and fear of COVID-19 were assessed at baseline and after 10 days. Repeated measures ANOVA with Bonferroni correction was used to assess between and within subjects' effects.

Results: The experimental group had better scores for depression, anxiety, stress, total DASS scores, and fear of COVID-19 ($p < 0.001$) when compared with the control group. Within the group, analyses demonstrated improved scores in all domains in the yoga group ($p < 0.001$) by the end of the intervention. In contrast, the control group improved only in stress scores ($p = 0.002$), total DASS scores ($p = 0.012$), and fear of COVID-19 ($p = 0.039$). There are no adverse effects seen with Yoga-based breathing practices in these patients.

Conclusion: Yoga-based breathing practices have been found to have positive impact on mental health among COVID-19-positive patients during hospitalization.

Trial registry number cri: CTRI/2022/03/041071 Clinical Trials-Registry in India.

1. Introduction

The novel coronavirus disease (COVID-19) caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has become a pandemic [1] [2]. The name of COVID-19 is recommended by the International Committee of Corona Virus Study Group (ICCSG) [3] Over time, newer variants with higher virulence have infected many people. Health systems across the world have faced various difficulties in

identifying, controlling, and managing COVID-19 cases and increasing mental issues [4]. However, a significant area of concern other than preventing the illness with its implications is mental health, both in infected and uninfected people [5–7].

COVID-19 has been reported to have affected over 40 million people worldwide, and about 90,000 positive cases were reported daily from India alone [8]. The previous studies found that anxiety (3.29%), depression (22.9%), stress (34%), and fear (46.9%), were seen in the

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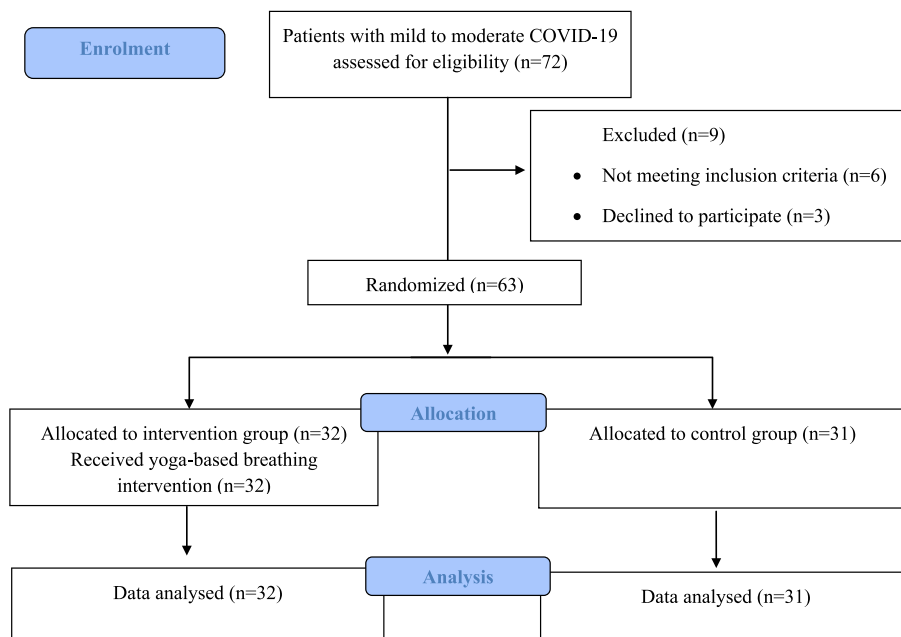


Fig. 1. Trail profile of participants of this study (n=72).

general community during the COVID-19 widespread around the world [9–12]. In the recent past, a study demonstrated females were facing a higher level of stress, depression, and stress than males, and fear [13]. Fear of death and different psychiatric manifestations were suggested at high rates in patients during COVID-19. Patients with COVID-19 who are admitted to clinical setup were at higher risk of psychological implications, given the seriousness of their illness and hospitalization under contact isolation [14]. Although COVID-19 patients were quarantined in COVID-19 hospitals to prevent the infections from spreading to another person, the absence of emotionally supportive care for the patients due to these mental problems, in turn, affects their disturbed sleeping routine and lowers the quality of living due to lack of management. [15]

Yoga, a mind-body technique, has been used extensively for its health benefits and therapeutic applications in recent times [16,17]. Yoga is proposed to be beneficial for COVID-19 patients [18]. Yoga-based breathing practices were found to help improve vagal tone and had a positive effect on mental health [19–23]. Yoga-based breathing practices had an impact on these practices in reducing the psychiatric manifestations [24,25]. Yoga-based breathing practices (Pranayama) are focused on breathing patterns, which promote mindfulness and mental health [26,27]. Previous studies have pointed out the effect of breathing on decreasing tension anxiety, increasing concentration awareness, and enhancing energy and positivity with alertness [16]. Such breathing practice is advised to reduce the physiological aging process on the level of health benefits such as mental, emotional, and physical health. There has been an increasing confirmation of the multiple supplementary advantages of Yoga-based breathing techniques [28]. A randomized controlled trial was conducted in the present study to evaluate the effect of Yoga-based breathing practices on the depression, anxiety, stress, and fear in patients diagnosed with COVID-19 during hospitalization.

2. Materials and methods

2.1. Design and participants

The study was conducted to evaluate the DASS-21 and fear of COVID-19 scores with COVID-19-positive patients (n=63) admitted to the hospital, who were randomly assigned to either the experimental group (n=32) or the control group (n=31). The simple random sampling was

facilitated by a random number generator and randomization was performed by an independent statistician blinded to the participants and researcher. Subsequently, a 30-min intervention involving Yoga-based breathing practices was administered to the experimental group. The assessment was done using the depression, anxiety, and stress (DASS-21) scale [29] as primary variable and fear of COVID-19 as secondary variable [30]. The assessments were done at two time points, pre- and post-intervention.

2.2. Eligibility criteria

COVID-19-positive infected patients confirmed by RT-PCR of the nasopharyngeal swab with mild to moderate symptoms of depression, anxiety, stress, and fear of death on clinical examination were recruited for the study from a hospital in North India. The patients capable of following instructions in Hindi or English languages for breathing practices were included. Inclusion criteria were COVID-19-infected patients with asymptomatic, mild, and moderate (febrile, body ache, nonproduction cough, and sore throat) symptoms of fear of death, anxiety, stress, and depression of both genders, the age group of 10–60 years, and willingness to be involved in the study. The exclusion criteria were patients on invasive ventilatory support, less than 90% Saturation of peripheral Oxygen (Spo2), pregnant and lactating females, with head injuries and who were not interested for the assessment tasks were excluded from the study.

2.3. Sample size calculation

The patients diagnosed with COVID-19 through the RT-PCR report and admitted to the ward of COVID-19 Hospital in North India were considered for the study. The sample size was calculated based on the effect size of anxiety using the post-mean and standard deviation of the experimental group (6.13±3.74) and control group (12.03±3.84), appropriately and the total sample size of 48 participants was calculated ($\alpha=0.05$), and power ($1-\beta=0.80$) by the G*power software, version 3.1.9.2 [31]. Due to the availability of interested participants (COVID-19 patients), we included 63 participants (to compensate for the dropout). The number of allocated patients in the experimental group was (n=32) and control group (n=31) respectively. The randomly selected participants were randomized and allocated by a random

Table 1
Details of Yoga-based breathing practices administered to the participants.

S.N.	Name of Yoga-based breathing Practices	Duration	Procedure of practices
1	Nadishodhana Pranayama	6 min	In the seated pose with cross-legged and spine aligned in a vertical line, begin by bringing the right thumb of the hand by adopting <i>Nasika mudra</i> to compress the right nostril, exhale completely through the left nostril, and inhale through the same left nostril. Close the left nostril using the ring finger of the right hand, then open the right nostril and exhale through the right nostril, again inhale through the same right nostril. Then compress the right nostril and exhale through the left nostril. Repeatedly process with the alternative inhaling and exhaling called Nadishodhana Pranayama. This sequence constitutes one round of the pranayama.
2	Relaxation	2 min	In the seated position, cross-legged with a straight spine, place both palms on the knee joints, and concentrate on breathing (normal inhaling and exhaling) with closed eyes.
3	Suryanuloma Viloma Pranayama	6 min	In the seated pose with cross-legged and spine aligned in a vertical line, begin bringing the right ring finger of the hand with the help of <i>Nasika Mudra</i> (folding the index and middle finger towards the palm). Compress the left nostril by the ring finger, inhale, and exhale performing by the right nostril only.
4	Relaxation	2 min	In the seated position, cross-legged with a straight spine, place both palms on the knee joints, and concentrate on breathing (normal inhaling and exhaling) with closed eyes.
5	Kapalbhati Pranayama	4 min	In the seated pose, with cross-legged and spine aligned in a vertical line. Inhale passively through both nostrils and exhale actively by the flapping movement of the abdomen.
6	Relaxation	2 min	In the seated position, cross-legged with a straight spine, place both palms on the knee joints, and concentrate on breathing (normal inhaling and exhaling) with closed eyes.
7	Bhramari Pranayama	6 min	In the seated pose, with cross-legged and spine aligned in a vertical line, insert index fingers into both ears. Inhale deeply through the nostrils, then exhale with a low-pitched humming sound from the throat with closed eyes.
8	Relaxation	2 min	In the seated position, cross-legged with a straight spine, place both palms on the knee joints, and concentrate on breathing (normal inhaling and exhaling) with closed eyes.

number generator (<https://www.randomizer.org/>).

2.4. Ethical considerations & trial registration

The present study has been registered under the Clinical Trial Registry of India (CTRI/2022/03/041071). After receiving ethical clearance from Atharva Multispecialty Hospital and Research Centre, India's

institutional ethical committee (AMHRC11/11/20). Before being explained to the patients in detail, the onset of enrollment and written informed consent with signs of patients were obtained from each patient. Then, this study was conducted at the COVID-19 hospital.

2.5. Intervention

We employed a randomized controlled study design in the present study. The experimental group performed Yoga-based breathing practices for 30 min per day for ten days and demonstration of Yoga-based breathing practice was done by a yoga expert. The intervention program of breathing practice was given to an experimental group, while the control group was not given any such treatment. The outcome comparison was assessed in both groups before and after the intervention (Table 1).

2.6. Assessment tools

This study utilized two question scales (DASS-21 and fear of COVID-19), the Depression, Anxiety, and Stress Scale –21 items (DASS-21), which is a sub-scale containing seven items. Question numbers 3, 5, 10, 13, 16, 17, and 21 consist of the depression subscale domain. The numbers 2,4,7,9,15,19,20 consist of the anxiety subscale domain, and 1,6,8,11,12,14,18 consists of the stress subscale domain. It assesses 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 [32]. In previous studies on the Indian population, many researchers have used the DASS-21 scale for success in assessing the psychological status of the COVID-19 pandemic in India [33–35]. The DASS-21 was validated in Indian populations with mental illness and has demonstrated reliability as Cronbach's coefficient: 0.761 to 0.906 [36]. In the present study, DASS-21, Cronbach's alpha is 0.695. The second scale is the fear of COVID-19 tool, a seven-scale, that has robust psychometric contents. Patients performed their condition of agreement using the Likert type scale from (strongly=1 to strongly agree=5), and the whole score was evaluated by adding the score (7–35). High's score indicates a severe fear of COVID-19 [30]. Also, it assesses of fear of COVID-19 scale used in the Indian population [37]. The validated and reliable used in the Indian population. The Cronbach's α value was 0.82 [38]. The Cronbach's alpha for the fear of COVID-19 scale is 0.630.

2.7. Statistical analysis

We used JASP 0.12.2.0. Version software for analyzing the data. Repeated measures Analysis of Variance (RM-ANOVA) was used for statistical analysis of the data.

3. Results

The project was administered between 09 March and 27 May 2022, and sixty-three (47 male) COVID-19-positive patients with average age, mean \pm SD (47.93 \pm 11.41) participated in the study. Based on the DASS-21 scores, 42.85% of the participants had symptoms of mild depression, 26.98 % moderate depression, 6.34% severe depression, and 1.59% extremely severe depression. 23.80% had mild anxiety, 46.03% had moderate anxiety, 11.11% had severe anxiety, and 1.59% had extreme anxiety. 28.57% had mild stress, 17.56% had moderate stress, and 7.76% had severe stress.

3.1. Within-group effects

Following the intervention, the experimental group demonstrated a significant decrease in depression, anxiety, and stress scores ($p<0.001$) along with DASS-21 total scores ($p<0.001$). The fear of COVID-19 scores was also significantly reduced in the experimental group compared to

Table 2
Results of intervention and control groups at pre and post 10 days of follow-up.

Variables	Intervention group (n = 32)					Control group (n = 31)					Time * Group interaction	
	Pre	95 % CI LU to UB	Post	95 % CI LB to UB	Cohen's d	Pre	95 % CI LB to UB	Post	95 % CI LB to UB	Cohen's d	Partial eta squared	p-value
Depression Scores	12.88 ± 5.82	10.78 to 14.97	5.29 ± 3.43***	4.05 to 6.52	1.122	11.75 ± 3.83	10.35 to 13.15	10.33 ± 3.23	9.14 to 11.51	0.343	0.237	<0.001
Anxiety Scores	11 ± 4.98	9.21 to 12.80	2.91 ± 2.66***	1.95 to 3.87	1.498	10.78 ± 3.603	9.46 to 12.10	8.46 ± 3.79	7.07 to 9.85	0.523	0.259	<0.001
Stress Scores	15.85 ± 5.52	13.86 to 17.84	6.19 ± 3.39***	4.97 to 7.41	1.731	15.81 ± 4.24	14.26 to 17.37	12.46 ± 4.56**	10.79 to 14.13	0.797	0.295	<0.001
DASS-21 Total Scores	39.72 ± 13.24	34.95 to 44.49	14.38 ± 7.48***	11.68 to 17.08	1.805	38.33 ± 9.19	34.96 to 41.70	31.17 ± 9.76*	27.59 to 34.74	0.702	0.360	<0.001
Fear of COVID-19 Scores	23.79 ± 2.57	22.86 to 24.71	17.54 ± 2.603***	16.60 to 18.48	1.678	25.39 ± 1.97	24.67 to 26.11	23.91 ± 1.78*	23.26 to 24.56	0.831	0.405	<0.001

Repeated Measures Analysis of Variance with Bonferroni Corrections. * $p < 0.05$, ** - $p < 0.01$, *** - $p < 0.001$. UB = Upper bound, LB = Lower bound 95%.

the baseline ($p < 0.001$). There were no significant effects observed in the depression and anxiety scores in the control group. There was a significant reduction in stress scores ($p = 0.002$), DASS-21 total scores ($p = 0.012$), and fear of COVID-19 scores ($p = 0.039$); however, the magnitude of change was much lesser in the control group.

3.2. Between-group effects

Between-group analyses demonstrated significant interaction in all domains and total scores of DASS-21 ($p < 0.001$) and fear of COVID-19 ($p < 0.001$). The group means \pm SD scores are listed in (Table 2).

4. Discussion

A large number of people, both infected and non-infected, faced the psychological implications of the COVID-19 pandemic. Yoga intervention was suggested for enhancing psychological, physical, and immunological functions in patients with COVID-19 by both scientists [18,39] and the Government of India [40]. Based on the AYUSH system of medicine, the government of India recommended yoga and naturopathy interventions to enhance the immunity of COVID-19 patients [41]. The current study was designed to assess the effect of Yoga-based breathing on the mental state of patients hospitalized with COVID-19. The results indicated positive benefits of Yoga-based breathing on the depression, anxiety, stress, and fear of COVID-19 when compared to the control group who received standard care. The results from our study were similar to the study conducted on yoga for COVID-19-affected people when we compared it to a different study that included meditation, which was not significant on the anxiety level in isolation wards [42].

In the present study, we demonstrated only Yoga-based breathing practices had improve the mental health of COVID-19 patients. A study on online yoga sessions for people working from home due to the pandemic demonstrated yoga practices are beneficial in reducing depression and perceived stress along with improving mental well-being [43]. Healthcare workers were found to have benefited from the practice of yoga for reducing depression, anxiety, and stress, as depicted by DASS-21 scores [44]. A study conducted on COVID-19 patients demonstrated yoga is found to be effective in reducing stress, anxiety, and depression followed by yoga. The study, similar to ours, showed a reduction in anxiety for the control group as well. However, the magnitude of change was higher in the yoga group [45]. A cross-sectional study demonstrated the effectiveness of yoga in maintaining mental well-being during the pandemic [46]. A contemplative self-healing study was performed and revealed a positive improvement in mental health among gynecological and breast cancer patients after radiation and chemotherapy [47]. There is also evidence that yogic breathing can be effective in reducing anxiety, depression, and stress, as indicated in another study [48,49]. Thus, yoga practices have been

shown to be effective during the pandemic, and our study also contributes to this body of evidence. Various reviews indicate positive benefits of yoga practices in depression and anxiety in patients with cancer [50], COPD [51], as well as pregnancy [52], psycho-physical well-being [53], reduced infection risk, increased lung function, enhanced autonomic function, and improve sleep quality in healthy individuals [54].

As demonstrated in various studies, yoga is known for its stress-ameliorating effects [55–57]. Yoga practices, especially breathing practices, were found to be helpful in individuals who were suffering from distress due to natural calamities [58,59]. Therefore, the application of yogic breathing to improving the psychological well-being of patients with COVID-19 which was an extension of such studies on yoga. The possible mechanisms involved in such a beneficial role of yogic breathing which had includes modulation of the autonomic nervous system [22] to reduce the hyperactivity of the sympathetic nervous system and enhance the performance of the parasympathetic nervous system [60] and also to increased the vagus nerve activity, promote emotional regulation, reducing the hyperactivity of the amygdala associated with fear responses. Moreover, the role of Yoga-based breathing (pranayama) in depression management is evident in its ability to enhance neurotransmitter release, including serotonin and gamma-aminobutyric acid (GABA), contributing to mood stabilization [61]. Earlier studies on yogic breathing have also demonstrated the beneficial role of yogic breathing in enhanced physiological and psychological functions [62].

The strength of the study includes offline administration of guided sessions of yogic breathing in COVID-19 hospital wards and without dropping the participants during the intervention. The major limitation is the absence of an objective assessment. Another important limitation of the study is the absence of an active control group whereby between-group analysis could yield a conclusive result by ruling out the placebo effect and knowing the real impact of Yoga-based breathing practices.

5. Conclusion

The study reported that Yoga-based breathing practices significantly impacted the management of psychological well-being for patients with COVID-19 mild and moderate symptoms in hospitalized in addition to the conventional management. Thus, our findings suggest that Yoga-based breathing practices is harmless, non-invasive, economical, and simple procedure that could be beneficial in the management of psychological symptoms such as depression, anxiety, and stress in future pandemics.

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Data availability

Data can be obtained from the author on request.

CRedit authorship contribution statement

Sunil Singh Yadav: Conceptualization, Writing – original draft, Writing – review & editing, Funding acquisition, Study design, Supervision, Project administration. **Apar Avinash Saoji:** Study design, Conceptualization, Writing – review & editing, Formal analysis, Software. **Sangeeth Somanadhapai:** Conceptualization, Investigation, Study design, Writing – review & editing. **Nand Lal Yadav:** Visualization, Study design. **Junu Upadhyay:** Writing – original draft, Data curation. **Niraj Nayan Rishi:** Software. **Rita Thapa:** Writing – review & editing.

Declaration of competing interest

The authors declare that they have no competing financial interests or personal relationships that might have influenced the work in this paper.

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References

- Rastogi S, Pandey DN, Singh RH. COVID-19 pandemic: a pragmatic plan for ayurveda intervention. *J Ayurveda Integr Med* 2022;13:100312. <https://doi.org/10.1016/j.jaim.2020.04.002>.
- Hossain MM, Tasnim S, Sultana A, Faizah F, Mazumder H, Zou L, et al. Epidemiology of mental health problems in COVID-19: a review. *F1000Research* 2020;9:636. <https://doi.org/10.12688/f1000research.24457.1>.
- Ram TS, Munikumar M, Raju VN, Devaraj P, Boiroju NK, Hemalatha R, et al. In silico evaluation of the compounds of the ayurvedic drug, AYUSH-64, for the action against the SARS-CoV-2 main protease. *J Ayurveda Integr Med* 2022;13:100413. <https://doi.org/10.1016/j.jaim.2021.02.004>.
- Ransing R, Pinto da Costa M, Adiuquvu F, Grandinetti P, Schuh Teixeira AL, Kilic O, et al. Yoga for COVID-19 and natural disaster related mental health issues: Challenges and perspectives. *Asian J Psychiatr* 2020;53:102386. <https://doi.org/10.1016/j.ajp.2020.102386>.
- Hossain MM, Tasnim S, Sultana A, Faizah F, Mazumder H, Zou L, et al. Epidemiology of mental health problems in COVID-19: a review [version 1; peer review: 2 approved] report. 2020. <https://doi.org/10.12688/f1000research.24457.1>.
- Rajkumar RP. COVID-19 and mental health : a review of the existing literature. *Asian J Psychiatr* 2020;52:102066. <https://doi.org/10.1016/j.ajp.2020.102066>.
- Shetty SK, Rao PN, U S, Raj A, Ks S, Sv S. The effect of Brahmi (*Bacopa monnieri* (L.) Pennell) on depression, anxiety and stress during Covid-19. *Eur J Integr Med* 2021;48:101898. <https://doi.org/10.1016/j.eujim.2021.101898>.
- Jagadeesan T, R A, R K, Jain T, Allu AR, Selvi GT, et al. Effect of Bhramari Pranayama intervention on stress, anxiety, depression and sleep quality among COVID 19 patients in home isolation. *J Ayurveda Integr Med* 2022;13. <https://doi.org/10.1016/j.jaim.2022.100596>.
- Jenefer Jerrin R, Theebika S, Panneeselvam P, Venkateswaran ST, Manavalan N, Maheshkumar K. Yoga and Naturopathy intervention for reducing anxiety and depression of Covid-19 patients – a pilot study. *Clin Epidemiol Glob Heal* 2021;11:100800. <https://doi.org/10.1016/j.cegh.2021.100800>.
- Wang C, Tee M, Roy AE, Fardin MA, Srichokchatchawan W, Habib HA, et al. The impact of COVID-19 pandemic on physical and mental health of Asians: a study of seven middle-income countries in Asia. *PLoS One* 2021;16:1–20. <https://doi.org/10.1371/journal.pone.0246824>.
- Srivastava A, Bala R, Srivastava AK, Mishra A, Shamim R, Sinha P. Anxiety, obsession and fear from coronavirus in Indian population: a web-based study using COVID-19 specific scales. *Int J Community Med Public Heal* 2020;7:4570. <https://doi.org/10.18203/2394-6040.ijcmph20204763>.
- Kaur T, Ranjan P, Chakrawarty A, Kasi K, Berry P, Suryansh S, et al. Association of sociodemographic parameters with depression, anxiety, stress, sleep quality, psychological trauma, mental well-being, and resilience during the second wave of COVID-19 pandemic: a cross-sectional survey from India. *Cureus* 2021;13. <https://doi.org/10.7759/cureus.16420>.
- Sarwal R, Dhamija RK, Jain K, Basavaraddi IV. Efficacy of pranayama in preventing COVID-19 in exposed healthcare professionals: a quasi-randomized clinical trial. *J Ayurveda Integr Med* 2023;14:100586. <https://doi.org/10.1016/j.jaim.2022.100586>.
- Dra A, Chancy M, Mendoza A, Fundación U, Estudiante L. Priapismo isquémico refractario . Complicación tromboembólica secundaria a la infección severa por SARS-CoV2. Reporte de caso y revisión de la literatura 2021;2021:12890. <https://doi.org/10.12890/2020>.
- Singh S, Roy D, Sinha K, Parveen S, Sharma G, Joshi G. Impact of COVID-19 and lockdown on mental health of children and adolescents: a narrative review with recommendations. *Psychiatr Res* 2020;293:113429. <https://doi.org/10.1016/j.psychres.2020.113429>.
- Saoji AA, Raghavendra BR, Manjunath NK. Effects of yogic breath regulation: a narrative review of scientific evidence. *J Ayurveda Integr Med* 2019;10:50–8. <https://doi.org/10.1016/j.jaim.2017.07.008>.
- Swathi PS, Raghavendra BR, Saoji AA. Health and therapeutic benefits of Shatkarma: a narrative review of scientific studies. *J Ayurveda Integr Med* 2021;12:206–12. <https://doi.org/10.1016/j.jaim.2020.11.008>.
- Nagarathna R, Nagendra H, Majumdar V. A perspective on yoga as a preventive strategy for coronavirus disease 2019. *Int J Yoga* 2020;13:89–98. https://doi.org/10.4103/ijoy.IJOY_22_20.
- Sacco MA, Caputo F, Ricci P, Sicilia F, De Aloe L, Bonetta CF, et al. The impact of the Covid-19 pandemic on domestic violence: the dark side of home isolation during quarantine. *Med Leg J* 2020;88:71–3. <https://doi.org/10.1177/0025817220930553>.
- Venugopal V, Pamavathi R, Venkateswaran S, Gunasekaran D, Maheshkumar K. Protecting the elders from COVID- 19 impact-leveraging yoga. *J Fam Med Prim Care* 2020;9:4487. https://doi.org/10.4103/JFMPC.JFMPC_797_20.
- Thanalakshmi J, Maheshkumar K, Kannan R, Sundareswaran L, Venugopal V, Poonguzhali S. Effect of Sheetali pranayama on cardiac autonomic function among patients with primary hypertension - a randomized controlled trial. *Compl Ther Clin Pract* 2020;39:101138. <https://doi.org/10.1016/j.ctcp.2020.101138>.
- Saoji AA, Raghavendra BR, Manjunath NK. Immediate effects of yoga breathing with intermittent breath retention on the autonomic and cardiovascular variables amongst healthy volunteers. *Indian J Physiol Pharmacol* 2018;62:41–50.
- Upadhyay J, S NN, Shetty S, Saoji AA, Yadav SS. Effects of Nadishodhana and Bhramari Pranayama on heart rate variability, auditory reaction time, and blood pressure: a randomized clinical trial in hypertensive patients. *J Ayurveda Integr Med* 2023;14:100774. <https://doi.org/10.1016/j.jaim.2023.100774>.
- Rain M, Subramaniam B, Avti P, Mahajan P, Anand A. Can yogic breathing techniques like simha kriya and isha kriya regulate COVID-19-related stress? *Front Psychol* 2021;12:1–13. <https://doi.org/10.3389/fpsyg.2021.635816>.
- Shukla M, Chauhan D, Raj R. Breathing exercises and pranayamas to decrease perceived exertion during breath-holding while locked-down due to COVID-19 online randomized study. *Compl Ther Clin Pract* 2020;41:101248. <https://doi.org/10.1016/j.ctcp.2020.101248>.
- Swami M. *Hatha yoga pradipika*. fourth ed. Munger, Bihar, India: Yoga Publications Trust; 2012.
- Kulkarni MS, Kakodkar P, Nesari TM, Dubewar AP. Combating the psychological impact of COVID-19 pandemic through yoga: recommendation from an overview. *J Ayurveda Integr Med* 2021:100433. <https://doi.org/10.1016/j.jaim.2021.04.003>.
- Jagadeesan T, R A, R K, Jain T, Allu AR, Selvi GT, et al. Effect of Bhramari Pranayama intervention on stress, anxiety, depression and sleep quality among COVID 19 patients in home isolation. *J Ayurveda Integr Med* 2022:100596. <https://doi.org/10.1016/j.jaim.2022.100596>.
- Beaufort IN, De Weert-Van Oene GH, Buwalda VAJ, De Leeuw JRJ, Goudriaan AE. The depression, anxiety and stress scale (DASS-21) as a screener for depression in substance use disorder inpatients: a pilot study. *Eur Addiction Res* 2017;23:260–8. <https://doi.org/10.1159/000485182>.
- Ahorsu DK, Lin CY, Imani V, Saffari M, Griffiths MD, Pakpour AH. The fear of COVID-19 scale: development and initial validation. *Int J Ment Health Addiction* 2020. <https://doi.org/10.1007/S11469-020-00270-8>.
- Article O, El-azzab SI. Effectiveness of psycho-educational program to alleviate depression , anxiety , stress , pessimism and provide optimism for COVID-19 isolation nurses. 2021. p. 12.
- Lovibond PF, Lovibond SH. The structure of negative emotional states: comparison of the depression anxiety stress scales (DASS) with the beck depression and anxiety inventories. *Behav Res Ther* 1994;33:335–43.
- Grover R, Dua P, Juneja S, Chauhan L, Agarwal P, Khurana A. “Depression, anxiety and stress” in a cohort of registered practicing ophthalmic surgeons, post lockdown during COVID-19 pandemic in India. *Ophthalmic Epidemiol* 2021;28:322–9. <https://doi.org/10.1080/09286586.2020.1846757>.
- Hazarika M, Das S, Bhandari SS, Sharma P. The psychological impact of the COVID-19 pandemic and associated risk factors during the initial stage among the general population in India. *Open J Psychiatr Allied Sci* 2021;12:31. <https://doi.org/10.5958/2394-2061.2021.00009.4>.
- Verma S, Mishra A. Depression, anxiety, and stress and socio-demographic correlates among general Indian public during COVID-19. *Int J Soc Psychiatr* 2020;66:756–62. <https://doi.org/10.1177/0020764020934508>.
- Reddy VV, Revanth Karri S, Jezreel T, Afeen S, Khairkar P. Psychosocial impact of COVID-19 lockdown on mental wellbeing among 11 states of India: a markov modeling approach. *J Psychiatry Psychiatr Disord* 2020;4. <https://doi.org/10.26502/jppd.2572-519X0103>.
- Doshi D, Karunakar P, Sukhabogi JR, Prasanna JS, Mahajan SV. Assessing coronavirus fear in Indian population using the fear of COVID-19 scale. *Int J Ment*

- Health Addiction 2021;19:2383–91. <https://doi.org/10.1007/s11469-020-00332-x>.
- [38] Lathabhavan R. A psychometric analysis of fear of COVID-19 scale in India. *Int J Ment Health Addiction* 2021. <https://doi.org/10.1007/s11469-021-00657-1>.
- [39] Jasti N, Bhargav H, George S, Varambally S, Gangadhar BN. Tele-yoga for stress management: need of the hour during the COVID-19 pandemic and beyond? *Asian J Psychiatr* 2020;54:18–20. <https://doi.org/10.1016/j.ajp.2020.102334>.
- [40] Ministry of Ayush. Guidelines for yoga practitioners for COVID 19. Govt of India; 2020. <https://www.ayush.gov.in/docs/yoga-guidelines.pdf>.
- [41] Khanal P, Duyu T, Patil BM, Dey YN, Pasha I, Wanjari M, et al. Network pharmacology of AYUSH recommended immune-boosting medicinal plants against COVID-19. *J Ayurveda Integr Med* 2022;13:100374. <https://doi.org/10.1016/j.jaim.2020.11.004>.
- [42] Mahendru K, Pandit A, Singh V, Choudhary N, Mohan A, Bhatnagar S. Effect of meditation and breathing exercises on the well-being of patients with SARS-CoV-2 infection under institutional isolation: a randomized control trial. *Indian J Palliat Care* 2021;27:490. <https://doi.org/10.25259/IJPC.40.21>.
- [43] Wadhen V, Cartwright T. Feasibility and outcome of an online streamed yoga intervention on stress and wellbeing of people working from home during COVID-19. *Work* 2021;69:331–49. <https://doi.org/10.3233/WOR-205325>.
- [44] Vajpeyee M, Tiwari S, Jain K, Modi P, Bhandari P, Monga G, et al. Yoga and music intervention to reduce depression, anxiety, and stress during COVID-19 outbreak on healthcare workers. *Int J Soc Psychiatr* 2022;68:798–807. <https://doi.org/10.1177/00207640211006742>.
- [45] Sharma N, Sahni PS, Sharma US, Kumar J, Garg R. Effect of yoga on the stress, anxiety, and depression of COVID-19-positive patients: a quasi-randomized controlled study. *Int J Yoga Therap* 2022;32. <https://doi.org/10.17761/2022-D-22-00013>.
- [46] Priyanka Rasanias SK. A cross-sectional study of mental wellbeing with practice of yoga and meditation during COVID-19 pandemic. *J Fam Med Prim Care* 2021;10:1576–81. https://doi.org/10.4103/jfmpc.jfmpc.2367_20.
- [47] Loizzo JJ, Peterson JC, Charlson ME, Wolf EJ, Altemus M, Briggs WM, et al. The effect of a contemplative self-healing program on quality of life in women with breast and gynecologic cancers. *Alternative Ther Health Med* 2010;16:30–7.
- [48] McPherson F, McGraw L. Treating generalized anxiety disorder using complementary and alternative medicine. *Alternative Ther Health Med* 2013;19:45–50.
- [49] Ullas K, Maharana S, Metri KG, Gupta A, Nagendra HR. Impact of yoga on mental health and sleep quality among mothers of children with intellectual disability. *Alternative Ther Health Med* 2021;27:128–32.
- [50] Gonzalez M, Pascoe MC, Yang G, de Manincor M, Grant S, Lacey J, et al. Yoga for depression and anxiety symptoms in people with cancer: a systematic review and meta-analysis. *Psycho Oncol* 2021;30:1196–208. <https://doi.org/10.1002/pon.5671>.
- [51] Li Z, Liu S, Wang L, Smith L. Mind-body exercise for anxiety and depression in COPD patients: a systematic review and meta-analysis. *Int J Environ Res Publ Health* 2019;17:22. <https://doi.org/10.3390/ijerph17010022>.
- [52] Jarbou NS, Newell KA. Exercise and yoga during pregnancy and their impact on depression: a systematic literature review. *Arch Womens Ment Health* 2022;25:539–59. <https://doi.org/10.1007/s00737-021-01189-2>.
- [53] Di Mario S, Cocchiara RA, La Torre G. The use of yoga and mindfulness-based interventions to reduce stress and burnout in healthcare workers: an umbrella review. *Alternative Ther Health Med* 2023;29:29–35.
- [54] Trivedi GY, Saboo B. Bhamari Pranayama - a simple lifestyle intervention to reduce heart rate, enhance the lung function and immunity. *J Ayurveda Integr Med* 2021;12:562–4. <https://doi.org/10.1016/j.jaim.2021.07.004>.
- [55] Wang F, Szabo A. Effects of yoga on stress among healthy adults: a systematic review. *Alternative Ther Health Med* 2020;26:AT6214.
- [56] Guo P, Zhang X, Liu N, Wang J, Chen D, Sun W, et al. Mind-body interventions on stress management in pregnant women: a systematic review and meta-analysis of randomized controlled trials. *J Adv Nurs* 2021;77:125–46. <https://doi.org/10.1111/jan.14588>.
- [57] Flaegel K, Steinhäuser J. Evaluation of an interprofessional educational module on complementary and integrative medicine. *Eur J Integr Med* 2021;48:101913. <https://doi.org/10.1016/j.eujim.2021.101913>.
- [58] Telles S, Naveen KV, Dash M. Yoga reduces symptoms of distress in tsunami survivors in the andaman islands. *Evid Based Complement Alternat Med* 2007;4:503–9. <https://doi.org/10.1093/ecam/nem069>.
- [59] Descilo T, Vedamurtachar A, Gerbarg PL, Nagaraja D, Gangadhar BN, Damodaran B, et al. Effects of a yoga breath intervention alone and in combination with an exposure therapy for post-traumatic stress disorder and depression in survivors of the 2004 South-East Asia tsunami. *Acta Psychiatr Scand* 2010;121:289–300. <https://doi.org/10.1111/j.1600-0447.2009.01466.x>.
- [60] Trivedi G, Sharma K, Saboo B, Kathirvel S, Konat A, Zapadia V, et al. Humming (simple bhamari pranayama) as a stress buster: a holter-based study to analyze heart rate variability (HRV) Parameters during bhamari, physical activity, emotional stress, and sleep. *Cureus* 2023;15:e37527. <https://doi.org/10.7759/cureus.37527>.
- [61] Ma X, Yue Z-Q, Gong Z-Q, Zhang H, Duan N-Y, Shi Y-T, et al. The effect of diaphragmatic breathing on attention, negative affect and stress in healthy adults. *Front Psychol* 2017;8. <https://doi.org/10.3389/fpsyg.2017.00874>.
- [62] Jayawardena R, Ranasinghe P, Ranawaka H, Gamage N, Dissanayake D, Misra A. Exploring the therapeutic benefits of pranayama (yogic breathing): a systematic review. *Int J Yoga* 2020;13:99–110. https://doi.org/10.4103/ijoy.IJOY_37_19.