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Effect of cyclic meditation on anxiety and sleep quality in sailors on merchant ships—A quasi-experimental study

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Background: Sailors undergo anxiety and sleep disturbances due to prolonged journeys and the nature of their work on ships. Earlier studies indicate Cyclic Meditation (CM) being beneficial for managing anxiety and improving sleep quality. Thus, the current study was designed to investigate the effect of CM on anxiety and sleep quality among sailors.

Materials and methods: Fifty sailors were assigned to experimental ($n = 25$) and control ($n = 25$) groups. The experimental group received 45 min of CM, 7 days a week for 3 weeks. Control group continued with their routine activities and were offered CM practice the following 3 weeks. Hamilton Anxiety Scale for anxiety (HAM-A) and the Pittsburg Sleep Quality Index (PSQI) for sleep along with blood pressure and pulse rate were taken at baseline and by the end of 3 weeks. Data were analyzed using Repeated Measures Analysis of Variance (RM ANOVA) for within and between group effects.

Results: Significant differences were found between the groups following 3 weeks for all the variables. Experimental group demonstrated reduced anxiety ($p < 0.001$) and improved sleep ($p < 0.001$) along with improvements in blood pressure and pulse rate. The control group did not show any significant changes following 3 weeks.

Conclusion: CM could be incorporated as a routine for sailors to manage their anxiety and improve sleep quality during the period on board ships.

KEYWORDS

yoga, shipping, occupational health, meditation, sleep, psychological health

1 Introduction

Currently, 80% of the world trade is carried out by the international shipping industry (1). Waterborne vessels like barges, ships, boats, and sailboats are the only means of transport over the water bodies. The work of a sailor is to foresee the dangers and obstructions in the path of water-based vessels and manage cargo onboard ships and other vessels. According to the International Chamber of Shipping, the estimated worldwide population of seafarers serving on internationally trading merchant ships is 1,892,720. Of these, 857,540 are officers and 1,035,180 are ratings. The largest suppliers of ratings and officers working on merchant ships

are the Philippines, the Russian Federation, Indonesia, China, and India (2).

The shipboard environment and nature of shipping services can adversely impact physical and psychological health of the onboard personnel (3). A study conducted on over 1,000 sailors reported greater concerns over habitability (e.g., high noise, high temperature, extreme weathers, shaking movements etc.) were directly associated with poorer mood and greater symptoms of anxiety and depression (4). Furthermore, these sailors often work at rotating shifts, which itself can lead to increased stress and psychopathologies (5). Additionally, numerous studies have documented the adverse impact of these environment and occupational factors on sleep health and functioning (2, 4, 6), which have in turn impact on the psychological health (7). In addition, social factors such as separation from family and friends repeatedly and for prolonged duration, with limited communication due to technological constraints, and work schedules contribute to poor mental health (3, 8). These disruptions in communication and concerns about friends and family back home can lead to loneliness or greater deployment stress (9, 10). Also, interpersonal conflict in ships can lead to stress and psychological health problems among sailors (3). Thus, anxiety and poor sleep quality are common health issues among the sailors on board.

Several coping strategies are deployed to help sailors get through the difficult working environment. Team building activities bring cohesion among sailors, which can help them stay motivated and protect each other during their time on board (11, 12). To overcome or maintain their psychological health, many ships implement mental health programs, basic mental health facilities and access to counseling services for those who need them (13, 14). Several psychotherapy methodologies including cognitive behavioral therapy are employed to combat the mental health issues among sailors (15). In addition, physical and social programs like fitness facilities and movie screenings etc. are also encouraged while on board (16). Also participating in sports can boost mental health (17). The World Health Organization and National health agencies are providing guidelines related healthcare provision in ships, including the use of alternative and complementary medical practices (18). This expansion provides a great opportunity to demonstrate the usefulness of integrative health at the healthcare system level in various fields (19). The Taheri study, along with research by Camacho-Montaña LR (20) and Williams BA (21), highlights how confinement leads to decreased physical activity and poorer sleep quality among athletes, children, and prisoners, respectively. These findings underscore the detrimental impact of confinement on various occupational groups, contributing to adverse health outcomes within the population (22).

Yoga represents a holistic approach that encompasses multiple dimensions, combining physical, mental, social, and spiritual elements within its ambit. The beneficial effects of yoga have been evidenced across diverse occupational fields. In recent studies, yoga practices are found to be useful in managing pain (23), chronic venous insufficiency and fatigue (24), visual strain (25, 26) among various occupational groups. Specific yoga practices such as meditations have been found specifically for improving sleep as well as anxiety (27–29). The practice of laughter yoga has been effective in managing sleep disturbances in a recent study (30). Mindfulness-based meditation has been useful in reducing anxiety in various study populations (31, 32). The approach to practice of meditation has been diverse and various schools have evolved different types of meditation techniques.

Cyclic Meditation (CM) is one of the meditation techniques evolved based on the principle from the Mandukya Upanishad, one of the oldest texts in Indian wisdom (33). CM as a dynamic meditation technique is performed to master the mind, offering a pathway when thoughts overwhelm the mind. The CM practice involves cyclic stimulation through asanas and relaxation along with body awareness. Earlier studies of CM have shown significant improvement in the reduction of state anxiety and improvement in memory (34), induces a state of low physiological activation, reducing anxiety, decreasing stress, enhancing attention, and discriminative abilities, and promoting better sleep with increased slow-wave sleep (35, 36).

Numerous scientific studies have revealed that the mental well-being of sailors is at risk due to the inherently stressful and hostile environment of seafaring, which has been on the rise in recent years. Given that working and leisure time are spent in the same confined environment for prolonged periods, many stressors in seafaring can be considered chronic. Since they struggle with various mental conflicts, the practice of cyclic meditation proves beneficial in addressing these challenges. However, limited studies exist on this topic, underscoring the need for this study.

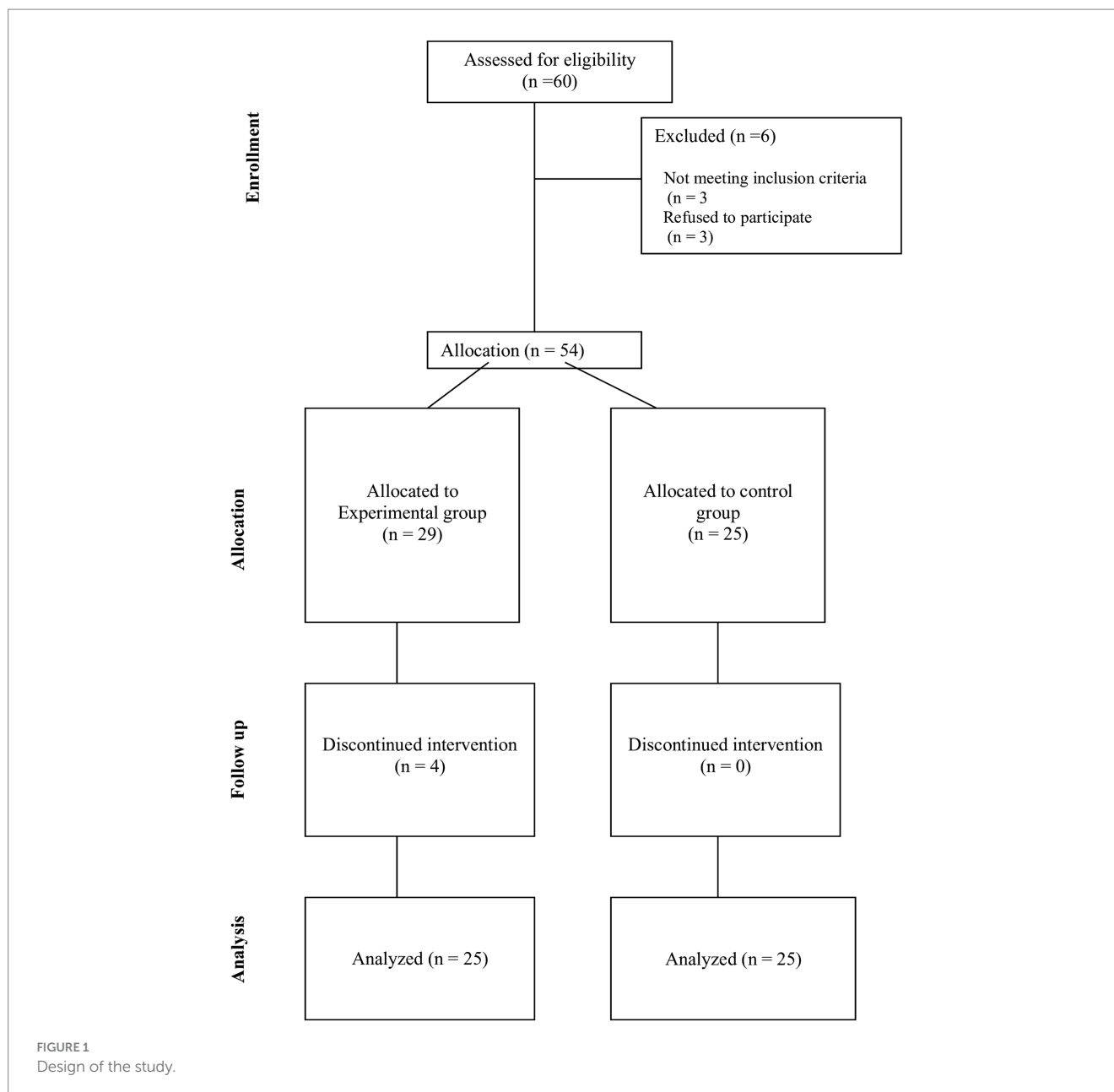
2 Materials and methods

Trial Design and Participants: A matched controlled study with a quasi-experimental design comprising two groups (experimental and control) was executed. A total of 72 male navy sailors from the merchant ships of Wedyan and Aslaf were briefed about the study protocol. The inclusion criteria of the study included volunteers who scored more than 18 on the pre-HAM A scale, which is considered moderate anxiety and severe, and who scored more than 5 in pre-PSQI, which is associated with poor sleep quality. We included participants with no prior experience with any type of Yoga practice. We excluded volunteers who are under medication and have any disease like the presence of cognitive or neurological disorders, respiratory or cardiac, and sensory abnormalities. Finally, 54 male navy sailors with their mean (\pm SD) age 37.74 (9.79) years were recruited to the study. The demographic data is depicted in Table 1. A quasi-experimental, non-randomized, matched control group was used. The participants were matched based on their, age, gender and rank, and then assigned to experimental or control groups. Both groups are taken from different ships namely Wedyan and Aslaf.

Ethical consideration: The Institutional Ethics Committee of the University approved the study. Clearance was obtained from the authorities of merchant ships of Wedyan and Aslaf to conduct the meditation sessions on board and written informed consent was obtained from individual participants before their recruitment to the study. We have ensured voluntary participation and we considered their schedules and privacy (Figure 1).

2.1 Intervention

Experimental: Cyclic meditation: Throughout the practice, subjects kept their eyes closed, and followed pre-recorded instructions. The instructions emphasized carrying out the practice slowly, with awareness and relaxation. The practice began by repeating a verse (40s) from the yoga text, the Mandukya Upanishad (33); followed by



stimulation and relaxation of the body. The practice lasted for a total of 45 min, with the intervention administered continuously for 21 days, keeping a gap of 90 min following dinner, starting from 8:30 PM and concluding at 9:15 PM each evening.

Cyclic Meditation is a structured procedure that alternates between stimulation and relaxation techniques. Participants begin by starting prayer for 2 min and lying down in a supine position, where they experience instant relaxation for 2 min. During this phase, all body parts are gently stretched and contracted simultaneously, aiding in calming the mind. Following this, the participant transitions to lying on their left lateral side, practicing linear awareness for a period. Then, they stand in Tadasana, balancing their weight evenly on both feet (centering) for 2 min. Next, participants perform asanas such as Ardha Kati Chakrasana on both sides, focusing on slow and steady movements while observing all sensations throughout the body for 4 min on each side. After the asana practice, the participant returns to

Shavasana. A quick relaxation technique is applied, focusing on abdominal movements and synchronization, followed by chanting 'aa' for 5 min. They then turn to the left lateral side and come to a sitting position with their legs stretched out for 2 min, followed by practicing Vajrasana, Ardha Ushtrasana, and Shashanka Asana, each for 2 min. The session concludes with the participant lying on their back in Shavasana for a deep relaxation technique. During this practice, the entire body is relaxed part by part, starting from the toes up to the head, with chanting of 'aa', 'uu', 'mm', and 'om' for 10 min. Afterward, a positive affirmation is repeated for 2 min, followed by a closing prayer for 3 min (37). The brief outline intervention is given in Table 2.

Waitlist Control Group: The control group participants were asked to continue their routine daily activities for the follow-up duration of 21 days. Following the 21 days, they were offered the same intervention as cyclic meditation.

TABLE 1 Demographic data comparing the baseline characteristics of the study participants.

Nationality	Experimental group (n = 25)	Control group (n = 25)	p-value
Filipino	15	19	0.326
Indian	7	3	
Jordanian	1	0	
Montenegrin	1	0	
Saudi Arabian	0	1	
Bulgarian	1	1	
Russian	0	1	
Ranking			
Officer	6	10	0.225
Rating	19	15	
AGE	37.44 (9.7)	38.40(10.4)	0.833
HAM_A	10.60 (7.8)	11.00(6.7)	0.846
PSQI	9.20 (2.3)	9.04(2.9)	0.829

Nominal data were compared using the Chi-square test, and ordinal and ratio data were compared using an independent sample *t*-test.

Assessments: The impact of cyclic meditation was assessed using self-report measures such as the Hamilton Anxiety Scale (HAM-A) for anxiety and the Pittsburg Sleep Quality Index (PSQI) for sleep. The assessment was conducted on the first day at the same time of the day, before the intervention, for both the experimental and control groups.

HAM-A assesses the presence and degree of severity of types of anxiety symptoms to provide a patient's status ranging from mild to severe. The scale, developed by Hamilton in 1959 the scale contains 14 entries. It uses the 5-level rating method of 0 to 4 points. The total score is 0~56, and the anxiety level can be divided as follows: < 7 means no anxiety, 7~14 means possible anxiety, 15~21 means certain anxiety, 21~29 means obvious anxiety, and > 29 means severe anxiety. Score 14 is generally the critical value. The Cronbach's α of the Hamilton Anxiety Scale was 0.77 to 0.92 (38, 39).

PSQI which is a validated questionnaire for the assessment of sleep patterns was developed by the University of Pittsburgh. It is a self-reported questionnaire that assesses sleep quality over a 1-month time interval, and addresses 7 components, i.e., subjective sleep quality, latency, duration, efficiency, disturbance, need for medications to sleep and day dysfunction due to sleepiness, with a maximum score being 21 points. A cut-off of five was considered to identify respondents with poor sleep quality. The Cronbach's α of the PSQI fluctuated between 0.70 and 0.85 (40, 41).

Evaluation of BP and PR: We evaluated the patient's BP and PR using an automated Oscillometric upper-arm BP monitoring device (Omron HEM7120). The participants were seated in a quiet room at a comfortable temperature and were instructed to avoid talking during the procedure. The BP measurements were started after the participants had rested for 5 min. The participants sat on a chair with their legs uncrossed and their feet flat on the floor. All BP measurements were performed on the participant's left arm at the level of the heart and have taken measurements at the same time. The BP and PR were recorded thrice in a single sitting and the average of the three recordings was taken to ensure reliability of the data.

Data Extraction and Analysis: The data for HAM-A and PSQI were extracted using questionnaire manuals and organized in Microsoft Excel version 2016. The BP was organized in systolic and diastolic BP and expressed as mmHg. PR was expressed in beats/min. Data analysis was performed using the JASP statistical package version 0.17.0 (42).

3 Results

A total of 54 participants took part in the study. Four participants were lost to follow-up in an experimental study, whose data were not considered for final analysis. Finally, the data of 50 participants were analyzed. The demographic data were compared using the Chi-square test, and ordinal and ratio data were compared using RM ANOVA. The demographic data is represented in Table 1.

3.1 Within-group changes

The RM ANOVA demonstrated significant within-subjects in HAM-A scores $F=18.653$, $p<0.001$; PSQI scores $F=33.391$, $p<0.001$, Systolic BP $F=8.231$, $p=0.006$, Diastolic BP $F=13.582$, $p<0.001$, Mean arterial pressure $F=19.757$, $p<0.001$, Pulse rate $F=10.109$, $p=0.003$. The within-subjects changes obtained through RM ANOVA are presented in Table 3.

3.2 Between-group changes

Pairwise comparisons between the groups performed through RM ANOVA with Holms corrections demonstrated significantly higher scores following cyclic meditation when compared with baseline for HAM-A scores, $t=-3.257$, $p=0.009$; PSQI scores, $t=-4.682$, $p<0.001$; Systolic BP, $t=-2.095$, $p=0.041$; Diastolic BP, $t=-2.446$, $p=0.018$; Mean arterial pressure, $t=0.717$, $p=0.015$; Pulse rate, $t=-2.037$, $p=0.014$. The effect sizes and t-values between groups using RM ANOVA with Holm's correction along with the group mean and SD are reported in Table 4.

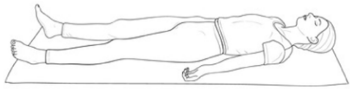






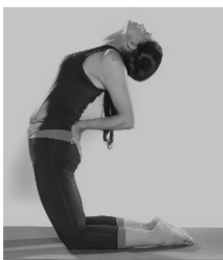

3.3 Adverse effects

Throughout the study, participants were encouraged to report any adverse effects to the investigators. Only two participants in the experimental group reported mild headaches following the practice of CM on the first day. No other adverse events were reported.

4 Discussion

The purpose of this study is to observe the impact of 21 days of Cyclic meditation intervention on sleep quality and anxiety levels in merchant navy sailors while on board the vessel. After 21 days of CM, statistically significant results are noticed in sleep quality, anxiety levels, and secondary variables of Systolic blood pressure and Diastolic Blood pressure, mean arterial pressure and pulse rate. To the best of our knowledge, this is the first study to assess the effect of cyclic meditation on anxiety and sleep quality in merchant navy sailors.

TABLE 2 Steps in cyclic meditation.

Steps	Particulars	Duration	
Step 1	<p>Starting Prayer: <i>laye sambodhayet chittam vikShiptam shamayet punah sakashayam vijaaniiyaat samapraaptam na chaalayet //</i></p> <p>Meaning: Stimulate and awaken the sleeping mind, calm down the distractions, recognize the innate stagnations and stay in steadiness without disturbing it.</p> <p>Source: Mandukya Karika (commentary on Mandukya Upanishad, one of the 10 principal Upanishads [part of Vedas])</p>	02 min	
Step 2	<p>Instant relaxation technique (IRT): Lying down in supine position</p> <p>During this phase, all body 2 parts are gently stretched and contracted simultaneously, aiding in calming the mind. Following 3 this, the participant transitions to lying on their left lateral side, practicing linear awareness for 4 a period</p>	02 min	 <p>IRT in Shavasana</p>
Step 3	<p>Standing Asanas</p> <p>Tadasana: balancing their weight evenly on both feet (centering) for 2 min</p> <p>Ardha Kati Chakrasana: focusing on slow and steady movements while observing all sensations throughout the body for 4 min on each side.</p>	10 min	 <p>Tadasana</p>  <p>Ardha Kati Chakrasana</p>
Step 4	<p>Quick relaxation technique (QRT):</p> <p>Focusing on abdominal movements and synchronization, followed by chanting 'aa.' 5 min</p>	05 min	 <p>QRT in Shavasana</p>
Step 5	<p>Sitting Asanas</p> <p>Dandasana: sitting position with their legs stretched out for 2 min</p> <p>Vajrasana: is sitting posture, sitting on the heels, and placing the knees, legs, feet together. Keeping the back straight and place the palms over the thighs. Focus on the breath. Total duration of 2 min.</p> <p>Shashankasana: from the vajrasana, lift your hands straight up and bend toward the ground and stretch the hands forward and touch the ground. Total duration of 2 min.</p> <p>Ardha-ustrasana: From the vajrasana, stand on the knees and place the hands on the waist finger pointing downwards, now bend the trunk and head backwards. Remain in the posture for half a min. Return to vajrasana and relax. Total duration of 2 min.</p>	08 min	 <p>Dandasana</p>  <p>Vajrasana</p>  <p>Shashankasana</p>  <p>Ardha Ustrasana</p>
Step 6	<p>Deep relaxation technique (DRT):</p> <p>During this practice, the entire body is relaxed part by part, starting from the toes up to the head, with chanting of 'aa', 'uu', 'mm', and 'om' for 10 min</p>	10 min	 <p>DRT in Shavasana</p>
Step 7	<p>Positive Resolve: positive resolution aligns with the concept of "sankalpa" or a positive resolve.</p>	05 min	

(Continued)

TABLE 2 (Continued)

Steps	Particulars	Duration
Step 8	<p>Closing Prayer:</p> <p><i>Sarve bhavantu sukhinaH sarve santu niraamayaaH</i> <i>sarve bhadraaNi pashyantu maa</i> <i>kashchidduHkhabhaagbhaveta</i> <i>Om shaantiH shaantiH shaantiH</i></p> <p>Meaning: May all be happy. May all be free from all diseases. May all see goodness and auspiciousness in everything. May none be unhappy or distressed. Om peace peace peace.</p> <p>Source: Brihadaranyaka Upanishad one of the 10 principal Upanishads (part of Vedas)</p>	03 min

TABLE 3 Results of the repeated measures analysis of variance (RM-ANOVA) for within-subject effects.

Variable	Time (df = 1.48)			Time*Group (df = 1.48)		
	F	p	η^2_p	F	p	η^2_p
HAM-A Scores	18.653	<0.001	0.280	21.782	< 0.001	0.312
PSQI Scores	33.391	<0.001	0.410	33.391	<0.001	0.410
Systolic Blood Pressure (mmHg)	8.231	=0.006	0.146	10.750	=0.002	0.183
Diastolic Blood Pressure (mmHg)	13.582	<0.001	0.221	10.790	=0.002	0.184
Mean Arterial Pressure (mmHg)	19.757	<0.001	0.292	19.992	<0.001	0.294
Pulse Rate (beats/min)	10.109	=0.003	0.174	9.452	=0.003	0.165

HAM-A, Hamilton Anxiety Rating Scale; PSQI, Pittsburgh Sleep Quality Inventory.

The study outcomes are similar to earlier studies of cyclic meditation. Based on a polysomnographic study conducted on 30 male participants, it was observed that CM for 2 days resulted in a decrease in the number of rapid eye movements and awakenings at night (35). Additionally, the self-rating of sleep showed an increase in the feeling that sleep was refreshing and an improvement of sleep duration (43). The immediate effect of CM was assessed by using the Wechler Memory Scale, Spielberg’s State Anxiety Inventory, and Digit Span Test. The results showed that the CM participants had a heightened memory score, improved attention, and a significant reduction in anxiety (34). Another study conducted on the immediate effect of CM evaluated the performance of participants on the Six letter cancellation test, this test is known to assess selective attention and visual scanning abilities. These findings suggest that CM has a positive impact on selection attention & visual scanning abilities (44, 45).

A study involving 26 asymptomatic male managers revealed that a two-day CM (stress management) program led to a notable decrease in both occupational stress levels and baseline autonomic arousal. This reduction in sympathetic activity indicates a significant positive impact. The mechanism driving the decline in stress levels may involve both decreased autonomic arousal and psychological factors. Coccharia’s research (46) supports this by highlighting the effectiveness of yoga in managing stress among occupational workers. Several other

studies indicate beneficial role of yoga practices in various occupational settings, including farmers (47), industry workers (23, 24), healthcare workers (48), computer professionals (26) etc. Consequently, employers are encouraged to incorporate yoga into their workplace wellness programs for its potential benefits in stress management (49).

According to epidemiological studies, 50% of individuals with anxiety suffer from sleep deprivation, particularly insomnia. This deprivation of sleep can lead to a negative impact on work efficiency. Work stress, which manifests as fatigue and frustration, is associated with various negative reactions, including job dissatisfaction, low organizational commitment, and a high propensity to resign. Ultimately, anxiety negatively impacts employee performance (50).

According to studies, practicing yoga has been shown to improve sleep and reduce anxiety levels (51), which in turn helps to reduce occupational stress and improve work efficiency (52, 53). Several nonpharmacological interventions that could help sleep disturbances have been in practice such as acupuncture and aromatherapy (54, 55). Our study’s results conform with these earlier findings from studies conducted in other work environments (56). However, this study is the first one conducted on board in a group of international seafarers, applying the intervention of Cyclic Meditation specifically. Our results of increased sleep quality and reduced levels of anxiety indicate better performance and could bring a safer work and living atmosphere on board.

Several limitations were encountered, as the study setting was on board the ships. The sample size was inevitably restricted, and collecting numerous samples simultaneously posed a challenge due to the crew working in shifts aboard the vessel. Also, the sample was restricted to male seaboard crew only, which limits the generalization of the results of this study. Additionally, the absence of an active control group could be considered another major limitation of the study. Longer interventions cannot be utilized as they may hamper the work rest hours onboard. More variables could have been used to make the study stronger.

5 Conclusion

The practice of 21 days of cyclic meditation led to positive changes in sleep quality and reduced anxiety in merchant navy sailors while sailing. This initial quasi-experimental study can pave the way for large-scale trials with robust designs and an active control group. Looking ahead, the long-term effects of cyclic

TABLE 4 Post-hoc analysis for RM-ANOVA with Holm's corrections.

Variable	Experimental group			Control group			Between group analyses for post-values				
	Pre	Post	t-value	Cohen's d	Pre	Post	t-value	Cohen's d	p-value	t-value	Cohen's d
HAM-A Scores	10.60 ± 7.77	5.44 ± 4.05***	6.364	0.825	11.00 ± 6.62	11.20 ± 5.97	-0.246	-0.032	=0.009	-3.257	-0.921
PSQI Scores	9.20 ± 2.29	6.00 ± 1.65***	8.872	1.394	9.04 ± 2.89	9.04 ± 2.16	0.000	0.000	<0.001	-4.682	-1.324
Systolic Blood Pressure (mmHg)	132.00 ± 9.73	125.40 ± 9.58***	4.347	0.690	130.48 ± 9.86	130.92 ± 9.03	-0.290	-0.046	=0.041	-2.095	-0.593
Diastolic Blood Pressure (mmHg)	82.96 ± 6.82	79.84 ± 6.17***	4.929	0.637	83.28 ± 4.31	83.08 ± 3.99	0.283	0.037	=0.018	-2.446	-0.692
Mean Arterial Pressure (mmHg)	99.31 ± 6.97	94.79 ± 6.57***	6.305	0.738	99.01 ± 5.62	99.03 ± 5.18	-0.019	-0.002	=0.015	-0.717	0.300
Pulse Rate (beats/min)	77.12 ± 5.97	72.36 ± 5.77***	4.422	0.846	75.56 ± 5.67	75.48 ± 5.03	0.074	0.014	=0.047	-2.037	-0.576

HAM: A, Hamilton Anxiety Rating Scale; PSQI, Pittsburgh Sleep Quality Inventory; ***p < 0.001 for within subject comparison.

meditation could offer valuable support in managing stressors inherent in ship life, thereby enhancing overall well-being. Additionally, there is potential to explore the impact of cyclic meditation on depression levels among sailors, offering promising avenues for future research and intervention.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Swami Vivekananda Yoga Anusandhana Samsthana. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

SP: Conceptualization, Data curation, Investigation, Project administration, Writing – original draft, Writing – review & editing. TG: Conceptualization, Data curation, Investigation, Project administration, Writing – original draft, Writing – review & editing. HV: Writing – original draft, Writing – review & editing. PS: Writing – original draft, Writing – review & editing. MP: Writing – original draft, Writing – review & editing. BP: Conceptualization, Formal analysis, Supervision, Writing – original draft, Writing – review & editing. NB: Supervision, Writing – original draft, Writing – review & editing. AS: Data curation, Formal analysis, Methodology, Software, Writing – original draft, Writing – review & editing.

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Conflict of interest

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