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Effect of Cyclic Meditation on Workplace Creativity: An EEG Based Study Protocol for Randomized Control Trial

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Abstract

Background and Aims: There is a clear and growing demand for enhanced creativity in corporate environments, as promoting creativity in the workplace is crucial for attaining organizational success and to be more resilient workplaces [1]. Studies show that more than 70% of corporate managers struggle with encouraging creativity in the workplace, which has a direct effect on innovation and performance within organizations [2]. Previous studies indicate that meditation may improve cognitive skills and promote creativity. However, the specific effects of Cyclic Meditation (CM) on workplace creativity have unexplored. This study aims to examine the impact of CM on workplace creativity in corporate managers, utilizing electroencephalography (EEG) to analyze the brain activity linked to creative thought processes.

Method and Procedure: This study aims to involve 60 corporate managers, who will be randomly placed into either a Cyclic Meditation (CM) intervention group or a control group who participate in Supine Rest (SR). Every group will participate in daily sessions lasting 35 minutes over a period of 12 weeks. Before and after the intervention, we will use the Alternative Uses Task (AUT) and the Global Measure of Creative Capacity (CSQ-R) to evaluate creativity. Additionally, we will carry out EEG measurements to observe brain activity.

Expected Results: This study attempts to provide an understanding into the impact of CM on workplace creativity, highlighting notable differences in creativity scores and EEG patterns between the CM group and the control group. The results could guide corporate wellness and mental health benefits programs for staff, emphasizing the importance of CM as an effective means to boost creativity in work environments.

Keywords: Workplace Creativity, EEG, Cyclic Meditation, Corporate Managers, Mental health.

1. Introduction

1.1. Background of the study

The global pandemic has significantly changed various aspects of life, bringing economic concerns to come up as a major issue. Many businesses, particularly small ones, are experiencing unbelievable difficulties, dealing with uncertainties that go beyond just the health crisis. In these unpredictable surroundings, creativity has emerged as a key factor that may separate success from failure for organizations. The pandemic has significantly influenced conventional business models, highlighting the necessity for corporate managers to be creative and innovative in

order to adjust to remote work, shifting consumer behaviors, and changing market conditions [3]. Innovative and out-of-the- box thinking could enable businesses not only to survive these tough times but also to identify pathways for growth and resilience [4].

Creativity in the workplace, particularly under the demands of the 21st century, has become an essential skill. In an era characterized by rapid change, complex internal and external environments, and heightened competition, organizations must cultivate flexibility, innovation, and creativity to remain relevant. Relying solely on traditional, mechanistic models of problem-solving is no longer viable [5]. A landmark survey by IBM of over 1,500 global CEOs highlighted the increasing importance of creativity, with leaders indicating that successfully navigating complexity requires creative problem-solving. However, more than half of these leaders admitted that their organizations are ill- prepared to confront such challenges [6]. Creativity in the workplace is not only crucial for solving immediate business challenges but also for fostering long-term innovation and sustainability.

Despite the well-documented need for workplace creativity, relatively few studies have focused on the impact of ancient wisdom practices, such as meditation, on enhancing creativity. While neuroscience has made significant strides in understanding the cognitive processes behind creativity, the link between meditation and creative thought remains underexplored, particularly through the lens of neuroimaging techniques. Recent research suggests that meditation could play a key role in fostering creative thinking by encouraging individuals to step back from problems and approach them with fresh perspectives.

1.2. Brief History on Creativity

Until the 1950s, creativity was linked to cognitive psychology and IQ. In mass education, students were “under the pressure to conform” [7] and discouraged from being creative [8], a practice that continues today. J. P. Guilford's 1950 American Psychological Association presidential address stated that “psychologists have seriously neglected the study of the creative aspects of personality” and stressed the need for scientific research on creativity. His work suggested that creative people develop divergent thinking skills more than others, including fluency, flexibility, originality, and the ability to elaborate and implement ideas. [9,10] refers to [11] the four-stage creativity model, which emphasizes conscious to unconscious to conscious. Understanding the creative process requires a deeper understanding of this phenomenon. Guilford calls Wallas's model superficial because mental actions are hard to test, but creativity scholars and practitioners use it. Contemporary calls for a clearer understanding of the creative process and the complexity of the conscious, unconscious mind and divergent thinking persist. Individual creativity has been studied extensively in various fields, including business, since Guilford's call to action. Numerous theoretical and empirical studies have helped organizations understand creativity. Many theorists expand Wallas's simpler creative process model. The two most relevant to group process are [12], which expand the four-stage model and elaborate on the final verification stage. Sawyer integrates many creativity models into the eight stages of the creative process:

1. Formulate the problem;
2. Acquire relevant knowledge;
3. Gather diverse information;
4. Incubate ideas;
5. Generate diverse ideas;
6. Combine ideas creatively;
7. Select the best ideas using relevant criteria;
8. Externalize the idea through materials and representations. [13]

These stages indicate that creativity is a more complex process, and organizations must understand them to foster employee creativity.

1.3. Cyclic Meditation and Its Role in Enhancing Workplace Creativity

Cyclic Meditation (CM), has its roots in ancient Indian traditions, particularly within the contexts of yoga and Vedanta teachings. Swami Vivekananda Yoga Anusandhana Samsthana (S-VYASA), a prominent institution in India, has established this as a modern and structured practice [14]. CM integrates both active and passive aspects from traditional yogic practices. The method involves moving between steps of involvement and breaks of rest, identical to the natural cycles of tension and relaxation in both the body and mind. This process assists individuals in achieving a more profound state of relaxation and enhanced clarity of thought. Cyclic Meditation draws its inspiration from the wisdom contained in ancient yoga texts like the Upanishads. It has gained interest for its potential to improve cognitive functioning, especially in high-stress environments [15] such as the workplace. In contrast to traditional mindfulness techniques, CM incorporates alternating cycles of physical postures and deep relaxation, designed to foster a state of relaxed alertness. This particular method has the potential to enhance creativity by encouraging cognitive flexibility [16], alleviating mental tiredness, and developing a flow state that allows for the easier emergence of creative concepts. Recent studies indicate that mindfulness practices [17] enhance creative performance by reducing mental barriers such as stress and cognitive rigidity, allowing individuals to tackle problems with new perspectives [18]. With a focus on both physical stimulation and mental relaxation, CM could support to be notably beneficial in boosting creativity in the workplace, enabling employees to deal with challenging duties more productively and develop innovative solutions.

1.4. Neurophysiological mechanisms Supporting Creativity: Evidence from EEG

Electroencephalography (EEG), which provides real-time details into brainwave activity during creative processes, has become known as a useful tool for understanding the neurophysiological mechanisms behind creativity [19]. Empirical studies have shown a connection between distinct brain activity patterns and creative thinking, especially in the alpha (8–12 Hz) and theta (4–7 Hz) frequency bands [20, 21, 22]. Innovative thinking, a fundamental aspect of creativity, has been found to increase during tasks requiring alpha waves, which are frequently associated with a calm yet alert mental state. Theta waves, which are generally linked to states of deep relaxation and meditation, have also been seen during epiphanies and creative brainstorming [23]. These brainwave patterns are modulated by meditation practices, which may improve creativity by encouraging cognitive flexibility and lowering mental noise, according to studies. For example, a study conducted in 2014 by Fink and Benedek revealed a correlation between higher creativity scores and increased alpha activity in participants completing idea generation tasks. Studies revealed that how such practices might enhance workplace creativity by using EEG to investigate brainwave patterns. In recent studies [24, 25], many of the researchers investigated low-cost portable electroencephalographic (EEG) systems such as MUSE to detect the brain signals. The outcome of these studies provided the validation of these systems as a feasible tool for research and opened up new doors for cognitive research where mobile measurement of brain performance is essential.

1.5. Rationale of the study

Creativity, defined as the ability to generate novel and useful ideas, is increasingly viewed as vital for organizational innovation, sustainability, and competitiveness in today's dynamic and uncertain business landscape [26]. While Western creativity literature has traditionally approached the subject as a universal process, it often overlooks the cultural dimensions that shape creativity. The role of indigenous practices, such as meditation rooted in ancient wisdom, remains largely neglected in mainstream studies.

2. Aim and Objectives

The main aim of this study is to investigate the effect of Cyclic Meditation on workplace creativity in corporate managers as measured by electroencephalography (EEG) the main objectives are:

i. To investigate the relationship between cyclic mediation and workplace creativity
ii. To analyze and understand the neuroimaging (EEG) data to unearth the impact of cyclic mediation on workplace creativity
iii. To confront the challenges of exploring this type of examination on an existing work group
iv. To ascertain opportunities for future research and expansion in this area, including modern relevance and efficacy

3. Materials and Methods

3.1. Sample Size

Sample size is estimated based on published study on personality traits and changes in electroencephalogram and autonomic nervous system activity during meditation. The purpose of this study was to investigate the relationship between Zen meditation and changes in psychophysiological parameters and traits assessed using Cloninger's Temperament and Character Inventory (TCI) in a sample of twenty healthy adults. While meditating, EEG recordings showed an increase in both speedy theta power and slowing alpha power, with the frontal lobe showing the most significant change. The meditation condition showed a statistically significant increase in theta2 power at the F3 and F4 and alpha1 power at the F3, F4, C3, and C4 electrodes compared to the control condition [theta2 (F3): t(19)=2.95, P=0.007; theta2 (F4): t(19)=3.03, P=0.006; alpha1 (F3): t(19)=5.72, Pb0.001; alpha1 (F4): t(19)=5.36, Pb0.001; alpha1 (C3): t(19)=5.43, Pb0.001; alpha1 (C4): t(19)=4.63, Pb0.001].

So finally, considering all these facts we have estimated 0.63 as an effect size and using G Power [27]. we have calculated 22 as a sample size for one group. So for intervention and control group the total sample size will be 44. Anticipating the dropouts, 70 as optimum a sample size considered here.

3.2. Selection and source of participants

The research will be conducted in a mid-sized IT firm based in Bangaluru, India from Nov 2024 to March 2025

3.3. Eligibility Criteria

Participants will be selected and screened on following criteria *Table 1*

Table 1
Eligibility criteria for the participants

Inclusion criteria	Exclusion criteria	Screening Criteria
Healthy corporate managers aged between 25 to 45 years and minimum 1 year of experience with existing organization	Individuals with MR and Neuroimaging incompatibility	Participants consistently scoring at the highest or lowest levels across all items) will be excluded from the study
Currently no practice of any meditation or yoga modules	Individuals with prior experience of meditation	On the basis of their historical health records available with the company
Neurological illness as assessed by GHQ (General Health Questionnaire) [27]	Individuals with previous or current use of substances or any psychoactive medications.	Individuals diagnosed with any disorders
Perceived stress as assessed by PSS (Perceived Stress Scale) [28] questionnaire	History of neurological or psychiatric disease	
Individuals with knowledge of English and Hindi	Individuals who are on notice period	

The General Health Questionnaire (GHQ) and the Perceived Stress Scale (PSS) will be utilized for the screening

criteria. The General Health Questionnaire (GHQ) is a reliable and valid questionnaire to assess psychological distress, with Cronbach's alpha between 0.82 and 0.86, indicating robust internal consistency. It has exhibited validity via a negative correlation with the global quality of life scale, indicating that heightened distress decreases quality of life. The GHQ- 12 adheres to a bifactorial model, encompassing both psychological distress and positive mental well-being [28].

The Perceived Stress Scale (PSS-10) demonstrates strong reliability and validity as an assessment tool. It has good internal consistency, with Cronbach's alpha ranging from 0.71 to 0.91, and strong test-retest reliability, as indicated by high Pearson correlations between repeated administrations. The PSS-10 shows strong construct validity through its correlation with the GHQ-28 and criterion validity via its association with the mental health component of the SF-36. [29].

3.4. Ethical consideration

The study will be conducted in full compliance with the ethical guidelines and regulatory framework established by the Institutional Ethics Committee (IEC) of Swami Vivekananda Yoga Anusandhana Samsthana University (SVYASA), Bangalore (Approval No. RES/IEC-SVYASA/227/2022). The research protocol has received ethical clearance, and the study has been registered in the Clinical Trials Registry of India (CTRI) under registration number CTRI/2022/04/042262**.** Any changes to the study protocol, especially those that impact participant safety or the results of the research, will be presented to the IEC for their review and approval prior to being put into effect. Future publications of the study will clearly document the amendments and their ethical clearance. This ensures a continuous dedication to the highest ethical standards all throughout the research process. Before participation, we will take written and oral informed consent from all participants. This ensures that all participants in the study are aware of its objectives, procedures, and advantages. All participants will be made aware that they can choose to stop their involvement in the study at any time without facing any repercussions.

3.5. Study Design

The design of this study involves a randomized controlled trial (RCT) that aims to assess the effects of Cyclic Meditation (CM) on the creativity of corporate managers in the workplace. Participants will be assigned into one of two groups: a CM intervention group and a control group that will participate in Supine Rest (SR, or shavasana). The program is scheduled to run for 12 weeks, with daily sessions occurring five days a week, each lasting 35 minutes. Assessments will take place before and after the intervention, featuring EEG measurements and evaluations of creativity. The study will employ a parallel-group design with two independent arms (CM and SR groups), allowing for a comparison of creativity outcomes between participants engaged in CM and those in the control group practicing SR (fig.1).

3.6. Randomization

Participants will be assigned at random to one of two groups:

-Cyclic Meditation group (n=30): These participants will undergo daily CM sessions.

-Supine Rest control group (n=30): These participants will practice supine rest (shavasana) for the same duration and frequency as the CM group. The randomization will be carried out using an online random number generator to ensure allocation concealment. Participants will be stratified based on their age and gender to ensure a balanced distribution across the two groups.

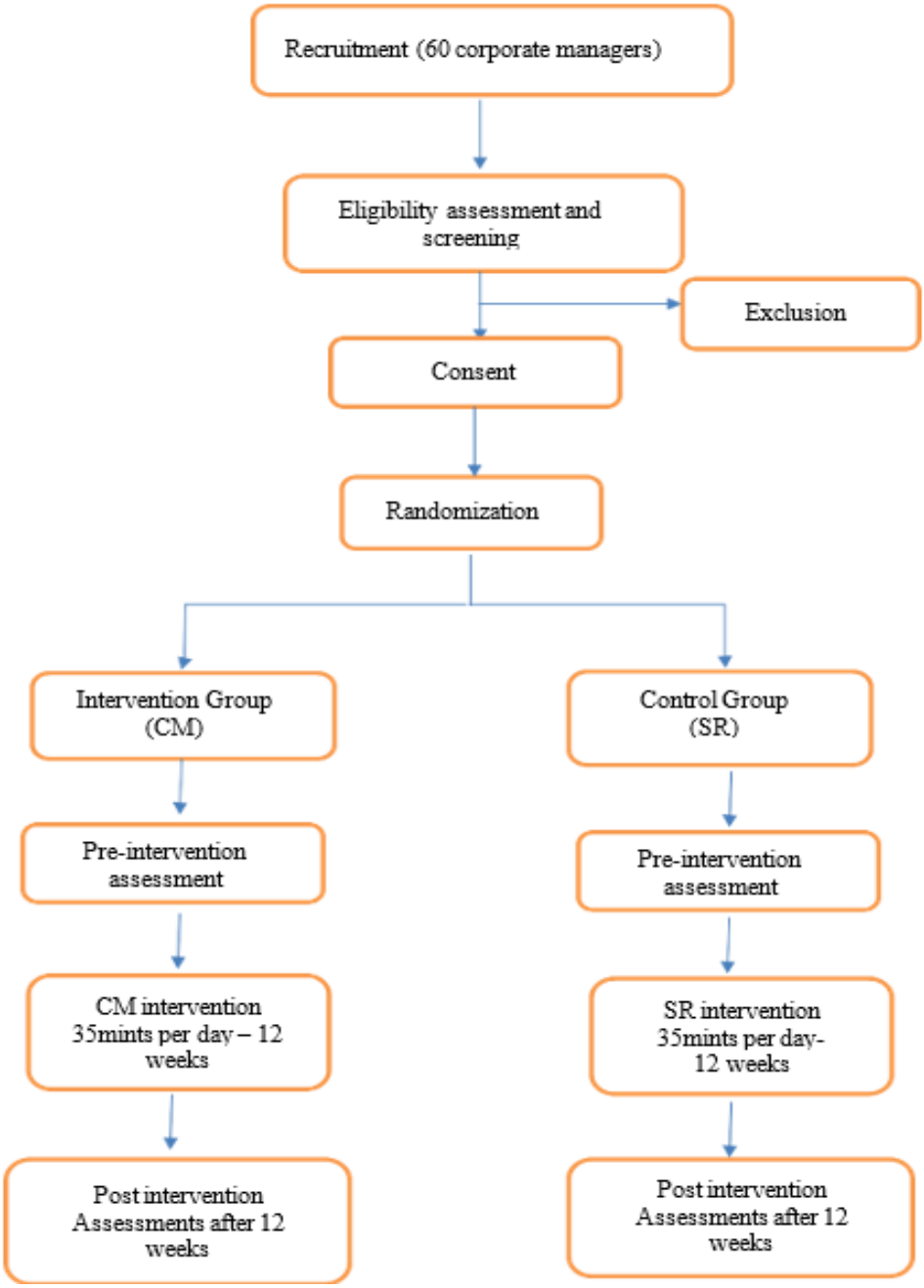

Fig.1: Study Design

3.7. Blinding

Although it is not possible to blind participants to the intervention, due to the nature of the meditation and rest practices, efforts will be made to blind the assessors of the outcome measures. The EEG data will be analyzed by researchers who are unaware of the participants' group allocation to ensure that outcome assessments are unbiased. Additionally, the creativity assessments, which include both subjective and objective measures, will be evaluated without knowledge of group assignment.

3.8. Intervention

3.8.1. Cyclic Meditation

Cyclic Meditation (CM) is a well validated yogic practice which combines alternating cycles of physical postures with deep relaxation. This method targets to improve mental clarity, alleviate stress, and boost overall cognitive performance. By combining moments of stimulation with relaxation, CM supports individuals in reaching a state of balanced mental focus, which can be particularly beneficial in high-stress environments such as the workplace. Its capacity to promote many aspects of life [30], cognitive flexibility [31, 32] and alleviate state of mind [33] makes it a valuable resource for enhancing creativity [34] and productivity in work environments.

Table 2 Details of cyclic meditation

Step	Practice	Time
1	Opening prayer - the practice starts with lead and follow of verse from a yoga text,the mandukya upanishad.	1 min
2	The Instant Relaxation Technique (IRT) consists in isometric contraction of the body's muscles followed by supine rest.	1 min
3	Centering - arriving in a standing posture with both feet firmly on the ground for tadasana	4 min
4.	Begin with the standing posture known as ardhakatichakrasana, transitioning from tadasana and bending to the right for 1 minute and 30 seconds. Follow this with a 1 minute and 30 seconds pause in tadasana, then bend to the left for another 1 minute and 30 seconds. Conclude with another 1 minute and 30 seconds pause in tadasana.	6 min
5.	Quick Relaxation Technique (QRT) involves Supine Rest (SR) accompanied by guided instructions, concluding with the chanting of AAA (AkArA) with an open mouth.	5 min
6.	Sitting postures include Vajrasana, Shashankasana, and Ushtrasana. Begin with Vajrasana for 1 minute, then bend forward into Shashankasana for 1 minute and 30 seconds, followed by a 1 minute and 30 seconds pause in Vajrasana. Next, bend backward into Ushtrasana for 1 minute and 30 seconds, concluding with another 1 minute and 30 seconds gap.	6 min
7.	Deep Relaxation Technique (DRT) gently transitioning to the supine position to enhance relaxation of various body parts in a sequential manner according to the guidance provided.	10 min
8.	The session will conclude with a two-minute closing prayer, focusing on the well- being of everyone present.	2 min

3.8.2. Supine Rest

A second group will participate in a 35-minute session of supine rest (Shavāsana), lying comfortably on a mat in a corpse posture with closed eyes. This structured method ensures that both groups are allotted equal time, with CM providing active engagement while the other group undergoes passive relaxation.

3.9. Assessment tools

3.9.1. Primary Measures

Creativity will be assessed using the Alternative Uses Task (AUT) [35], which looks at the fluency, originality, and flexibility of ideas. Additionally, the CSQ-R [36] will evaluate participants' self-perception of creativity, emphasizing unconscious processes, techniques, and outcome orientation.

EEG data will be collected before and following the intervention to assess changes in brainwave activity associated to creative thinking. The subsequent EEG metrics will be examined: High-alpha (10-13 Hz) and low-alpha (8-10 Hz) frequency bands The beta bands range from 13 to 30 Hz. We will assess these metrics at frontal (F3/F4) and parietal (P3/P4) sites. Electroencephalographic data will be recorded from a Muse EEG [37] headband (Muse Version: 2016) sampling at 256 Hz. The Muse EEG system has electrodes located analogous to Fpz, AF7, AF8, TP9, and TP10 with electrode Fpz utilized as the reference electrode during recording.

3.9.2. Secondary measures

The Creative Self-Questionnaire-Revised (CSQ-R) helps evaluate workplace outcomes related to creative capacity, including aspects such as sensory engagement, trust in unconscious processes, application of techniques, collaboration, emphasis on results, environmental management, and self-regulation of behavior. The reliabilities of the subscales, measured by Cronbach's alpha, vary from 0.45 to 0.81, with a median value of 0.74, [38] suggesting a moderate to good level of consistency.

4. Data extraction and analysis

In pre intervention in EEG room, we will assign one AUT task and during task we will record EEG signals and then we will conduct CSQ-R questionnaire. Throughout the phases, participants were given the opportunity to express their creativity using verbal, visual, and artistic methods, as well as shapes and lines. Additionally, the participants will be directed to create abstract, unconventional images and narrate a story. Individuals must assign titles to their creative tasks, thereby incorporating a minor verbal element into the activity. The overall index score is influenced by the optimized scoring system's evaluation of test performance, which is based on originality, fluency, elaboration, and flexibility. Fantasy, emotional expressiveness, storytelling, articulateness, movement, figure synthesis, humor, and rich imagery are among the many other creative strengths reflected in this score. In order to assess the results of creativity and originality, a self-report assessment called the CSQ-R will be used. The eight-item test includes the following: The Kumar and Holman Global Measure of Creative Capacity; faith in the unconscious process; technique application; teamwork; focus on end result; environmental control/behavioral self-regulation; superstition; and sensory utilization. The survey uses a Likert scale for responses and has 78 questions. This clarified the particular styles of creativity that will be presented both prior to and subsequent to engaging in the research study.

Electroencephalographic (EEG) recording, data acquisition, and analysis:

1. EEG recording will take place in EEG room under the supervision of a trained and experienced electrophysiologist.
2. We will use portable Muse 2 Headband for EEG recordings, which has 4 EEG electrodes (AF7, AF8, TP9, TP10)
3. A month-long training at the National Institute of Mental Health and Neurosciences (NIMHANS) Bengaluru, Karnataka, India or Manipal Hospital, Panaji, Goa, India will be undertaken to enhance proficiency in EEG processing and data interpretation before the intervention begins.

4. Neurophysicians from these hospitals will also provide support for interpreting EEG data to ensure clinical accuracy.
5. The open EEGLAB portal Interface: High-Performance computing with EEGLAB will be used to process the data, which is running on MATLAB R2009b from The Math Works Inc. in a Linux environment (Ubuntu 12.04).
6. To analyze the correlation between groups and experimental conditions, we will use Welch's ANOVA to determine the significance of EEG spectral power variations
7. Final statistical analysis will be performed using SPSS Version 20.0 (IBM, Armonk, NY, USA).
8. To compare differences in creativity and EEG outcomes within and between groups, independent t-tests will be used. This will be useful in figuring out how the intervention affected creative thinking and EEG readings, specifically ROIs.
9. Descriptive statistics will identify outliers and assess the normality of distributions for the key variables of interest.
10. We will conduct post hoc correlations to explore significant relationships between creativity scores and regions of interest in the frontal and parietal lobes, focusing on comparisons between the CM and SR groups along with their respective creativity scores.
11. Data administration entails the oversight of a research project, where a monitor is tasked with tracking the study's progress and safeguarding the rights and well-being of participants. The person will be solely for managing the code, ensuring security, and handling data storage. Additionally, the person will verify the correctness of data values by reprocessing them.

5. Discussion

This study aims to analyzes how Cyclic Meditation (CM) influences workplace creativity among corporate managers [39], a novel area of research that holds significant implications for enhancing cognitive flexibility [40] and productivity in professional settings. Previous research suggests that practices like meditation [41], mindfulness [42] and Cyclic Meditation [15,16,31,32,34] can enhance cognitive skills, including creativity, by reducing stress [15,44] and improving mental clarity and divergent thinking. This study uses a randomized controlled trial (RCT) design to provide robust evidence about the effects of CM on subjective creativity measures and objective neurophysiological [43] changes, evaluated through electroencephalography (EEG) [44] data. The use of EEG to evaluate brainwave activity linked to creativity provides a scientific foundation for understanding how CM affects specific neural patterns, such as low- and high-alpha and beta bands in the frontal and parietal regions of the brain, which are connected to creative thinking. The integration of the Alternative Uses Task (AUT) [45] and the Global Measure of Creative Capacity (CSQ-R) will enable a comprehensive assessment of both the behavioral aspects and self-perceptions related to creativity. While the study introduces fresh concepts, it is crucial to recognize the challenges such as the intricacies of participant blinding and the potential biases that come with self-reported creativity. Tackling these challenges with blinded assessments and comprehensive statistical analyses will enhance the reliability of the results. This study could lay the groundwork for future research on the long-term effects of CM and its broader significance across different professional fields. This study has the potential to make a significant contribution to corporate wellness programs, emphasizing the effectiveness of meditation practices such as CM as cost-efficient strategies to boost creativity and alleviate workplace stress, eventually leading to a workforce that is more resilient, productive and healthier.

6. Conclusion

This study aims to provide rigorous evidence on the effects of Cyclic Meditation on creativity in the workplace, using both neuroimaging (EEG) and behavioral assessments. The results may open the doors for future research

on the neural mechanisms underlying creative cognition and the practical application of meditation practices in corporate settings.

Confidentiality

Each participant will receive a unique identification number upon inclusion. The participant proforma will be employed to encode and archive data, which will subsequently be applied in Microsoft Excel. Access to the collected data will be restricted to the principal investigator and co-investigator only. The codes utilized for the random assignment of participants to trials will be maintained in strict confidentiality.

Access towards data and materials

The data sets produced and/or examined for the investigation into creativity do not pertain to the data sharing policy, as the article is specifically centered on a study protocol. Upon completion of the study, the de-identified data used to derive these conclusions will be included as an appendix in a peer-reviewed journal. Consequently, we consider that the data sharing statement will be pertinent to the final manuscript of the proposed study.

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