

An Easy and Time-effective Mind-body Technique for Relaxation and Rejuvenation

Abstract: By taking inspiration from malajapa, an age-old spiritual practice, we are describing here a time-effective and easy-to-follow mind-body relaxation technique (MBRT). The MBRT method has been proven to be useful in inducing sleep or calmness among undergraduate and postgraduate students in the classroom. The EEG study with a single participant displayed a noticeable increase in delta waves and a decrease in the higher-frequency waves during the MBRT practice. MBRT may be followed as a short-duration technique for relaxation and rejuvenation.

Keywords: Mind-Body technique, Meditation, Breath awareness, Relaxation, Rejuvenation

Human health and well-being are growing increasingly interested in mind-body approaches that combine mental practices with physical movement. By engaging both the mental and physical aspects, these approaches fundamentally relax and rejuvenate the mind-body system. Relaxation, in this context, acts as a process that mitigates the impact of stress on both our bodies and minds^{Available} at online: <https://www.mayoclinic.org/healthy-lifestyle/stress-management/in-depth/relaxation-technique/art-20045368>. The increasing prevalence of psychological challenges² and lifestyle disorders^{3,4} has prompted us to recognize the human body not merely as a sum of molecules but as an intricate mind-body complex.

Decades ago, Herbert Benson discovered the relaxation response when faced with the limitations of drug-based treatment of hypertension. Benson described two essential components to evoke a relaxation response⁵—First, repetition of a word, phrase, prayer, or muscular activity. Second, passively disregarding everyday thoughts that inevitably come to mind and returning to our repetition.

Meditation is a prime example of mind-body technique. It is worth mentioning that a significant number of practices typically linked to the way of life in India have a strong mind-body aspect. One of them is doing *japa* with *mala*. *Mala* and *karmala* are the two ancient

methods used to do *japa* (SI Fig.1). *Mala-japa* is done by reciting some mantra mentally, vocally, or with lip movement in coordination with moving beads on a string using thumb and fingers. Another type of doing *japa* is by *karmala* where thumb movement goes on finger divisions. Both methods of doing *mala* involve repetition of the *kriya* (action) up to a certain number of times with devotion. While these ancient practices are usually thought to be beneficial for spiritual or religious purposes, the implicit process of coordinating the mind with bodily activity can be relevant for mind-body balance in day-to-day life. This aspect of doing *mala* has been unexplored in the cultivation of mind and body relaxation. Here, a simplified technique, derived from *mala japa*, has been studied. This method employs the mind coordinating between breathing attention and thumb movement on finger divisions thereby removing the mind's dominance over the body and allowing the body and mind to relax and rejuvenate. It was hypothesized that the proposed mind-body relaxation technique (MBRT) can calm the mind and facilitate the body to relax and rejuvenate in a short duration.

Materials and Methods:

The Practice of the Mind-body Relaxation Technique in the Classroom: The procedure of mind-body relaxation technique (MBRT) has been illustrated in Figure 1. The study is an observational and one-group repetitive post-assessment design. 31 Students of both undergraduate and postgraduate classrooms belonging to 18-28 years of age joined in practicing the MBRT. The technique was introduced to all the participants. It had been practiced in a natural, classroom setting while sitting on their bench without any preconditioning. Out of 31 students, 28 students practiced it and 3 students participated but did not perform as it was optional to do. Every participant performed the MBRT at least one time, 9 participants performed it twice and 8 participants performed it thrice (SI Table-1). A total of 53 sessions were performed by 28 participants. A self-reported proforma consisting of 8 items was administered to participants following the practice session (the proforma can be found in the Supplementary Information). These items were designed to capture the participants' experiences during and after

the session. Prior to collecting responses for the study, informed consent was acquired from all participants involved.

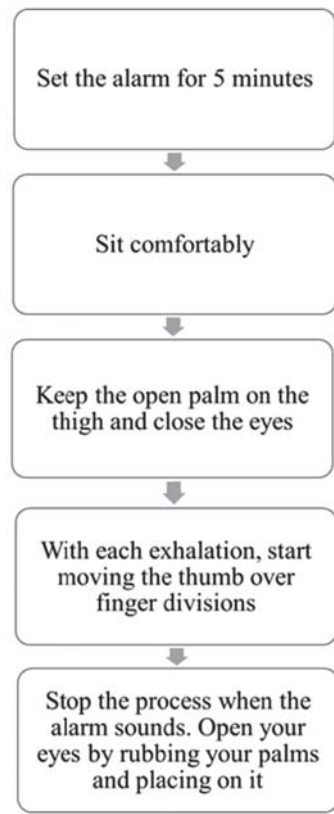


Fig. 1. The Procedure of Mind-body Relaxation Technique (MBRT) as Followed by the Practitioners.

Electroencephalogram Signal Acquisition and Analysis: Alterations in brain activity can be detected and quantified using Electroencephalogram (EEG) by analyzing various brain wave patterns⁶. Previously, variations in brain wave activity, as assessed through EEG, have been noted during the transition between wakefulness and sleep states, and vice versa⁷. The neural signature assessment utilized electroencephalogram (EEG) technology, which was accessible in the Department of Electronics and

Communication Engineering laboratory. Raw EEG data was acquired from a single participant within the cohort, as illustrated in Supplementary Figure 2 (SI Fig.2). This comprehensive assessment spanned a total of six sessions. During each session, EEG signals were recorded at three distinct time points, each spanning five minutes. These time points included measurements taken prior to, during, and after the MBRT practice, with a constant sampling frequency of 100 Hz. 8 channels ECI Electro-Cap Electrode System with international 10-20 placements and AD Instruments Bio-signal acquisition system were used for EEG signal acquisition.

For analysis, Fast Fourier Transform (FFT) has been performed on the filtered EEG signal to convert from the time domain to the frequency domain. In the next step, Power Spectral Density (PSD)⁸ was calculated using Welch's periodogram method to know the frequency sub-bands (Delta, Theta, Alpha, Beta, and Gamma) present in the EEG signal, which reflects different brain activity. The absolute power of EEG bands was calculated by integrating the area of Welch's Periodogram covered by the specific band using the composite Simpson's Rule⁹.

Statistical Analysis

The subjective responses provided by MBRT practitioners were classified into three distinct groups. To analyze the data, descriptive statistics and a chi-square test with a degree freedom of 2 were conducted.

Results

MBRT was practiced for five minutes by twenty-eight students in classroom and natural setting. Among these twenty-eight participants, 49.06% experienced brief sleep, 47.17% experienced calmness, and only 3.77% experienced no change. Details about participants' responses are given in SI Table 1. Results were also analyzed across different

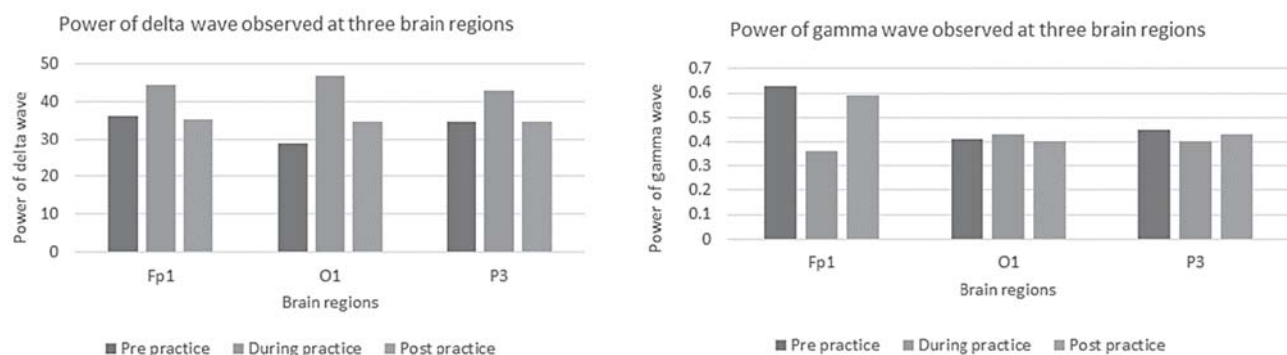


Fig. 2. Power of Delta and Gamma Waves as Observed at Prefrontal (Fp1), Occipital (O1), and Parietal (P3) Regions of Brain.

sessions. From the observation made (Table 1.1), it can be stated that in session 1 and session 2, participants experienced sleepy was the most frequent event (0.516, 0.545), followed by participants experienced calmness that was the second most frequent event (0.452, 0.318). In session 3, participants experienced calmness was the most frequent event (0.409) while experienced sleepy that was the second most frequent event (0.318). Therefore, it can be said that the MBRT induces sleep and brings calmness within a short duration of time. Results were also statistically significant ($p < 0.01$) on respondents' sleep and calmness (Table 1.2).

The magnitudes of distinct brain waves recorded from a participant in three specific brain regions: prefrontal, occipital, and parietal regions have been given in Table 2. In three specific brain regions, the delta wave power increased (23.14%, 62.25%, 23.86%) after MBRT practice compared to before the practice. The delta wave power returned to its baseline level in the two regions, with the exception of the occipital region, where only a modest reduction in delta activity was observed after five minutes. Various brain waves including theta, alpha, beta, and gamma, display higher frequencies than the delta wave. During the MBRT session, the brain waves showed a slightly decrease, returning to baseline within five minutes.

However, several noteworthy findings emerged from this study:

1. **Theta Waves:** In the prefrontal region, theta wave activity notably decreased by approximately 70%. Subsequently, five minutes after the MBRT practice, it rebounded to a level similar to that observed before engaging in the mind-body technique. This level of change in theta power was the most pronounced among all the five waves in all three regions.
2. **Alpha Waves:** Alpha wave power in the prefrontal region decreased during the MBRT session and then rebounded significantly within five minutes, surpassing the baseline recording.
3. **Gamma Waves:** During MBRT practice, gamma wave power reduced by 50% in the prefrontal lobe, reflecting a shift in brain activity. Notably, the prefrontal region appeared to be more influenced by the meditative process compared to the other two regions.

Discussion

MBRT involves synchronizing involuntary exhalation with deliberate thumb movements across finger divisions.

Feedback from participants following the practice indicated that MBRT induced calmness and a sleep state within five minutes. Additionally, examination of EEG signals in a single participant demonstrated alterations in neural oscillations while engaged in practice. While numerous studies have investigated the effects of meditation on various aspects of physiological well-being^{10,11,12,13,14}, there has been a lack of evidence regarding the unique experience of achieving a state of sleep during meditation, as observed in the context of the mind-body practice described in this study. It is worth noting that the primary purpose of meditation is not to induce sleep but to rejuvenate the body and mind. Patanjali characterizes sleep as a natural inclination of the mind, referred to as *Nidra vritti*¹⁵. We

Table 1.1 Frequency Distribution of Participant's Response after the Five Minutes of Mind-body Practice, Responses are of Eight Types.

Responses	1	2	3	4	5	6	7	8
Session 1	0.000	0.032	0.516	0.065	0.452	0.226	0.000	0.032
Session 2	0.091	0.136	0.545	0.136	0.318	0.045	0.227	0.000
Session 3	0.045	0.000	0.318	0.091	0.409	0.227	0.091	0.227

- 1- Slept/slept several times
- 2- Slept for some time
- 3- Sleepy
- 4- Remain awake
- 5- Remain awake and felt calm
- 6- Closed eyes but not moved thumb
- 7- Found difficult to keep eyes close
- 8- Did not participate

Table 1.2 - Analysis of Responses Categories Using the Chi-Square Test among Participants.

Values	Sleep	Calm	Neutral	DF	χ^2 Value	p-value
Observed	49.06	47.17	3.77	2	39.38	$p < 0.01$
Expected	33.33	33.33	33.33			

Table 2. Average Absolute Power of five different EEG frequency bands obtained from six trials. EEG signal has been acquired in three conditions from three brain regions through channels Fp1, O1, and P3. Inside the parenthesis standard deviation is given which suggests that the six trials performed showed a consistent effect in terms of brain wave power. Values, in each trial, are not much different. Fp1- Prefrontal, O1- Occipital, P3- Parietal

Conditions		Pre-Practice (Normal)	During Practice	Post-Practice (After 5 min.)
Freq.	Channel	Mean of Absolute Power in μV^2 (SD)		
Delta	Fp1	36.07 (0.43)	44.42 (0.36)	35.35 (0.41)
	O1	28.93 (0.29)	46.94 (0.37)	34.69 (6.6)
	P3	34.48 (0.36)	42.71 (2.27)	34.70 (0.54)
Theta	Fp1	7.15 (0.24)	1.99 (0.14)	7.55 (0.09)
	O1	4.14 (0.25)	2.13 (0.19)	3.64 (0.82)
	P3	3.44 (0.32)	2.25 (0.11)	3.30 (0.34)
Alpha	Fp1	1.73 (0.32)	1.11 (0.09)	2.29 (0.2)
	O1	3.77 (0.24)	2.59 (0.15)	3.65 (0.61)
	P3	2.48 (0.22)	3.02 (0.13)	2.59 (0.35)
Beta	Fp1	3.40 (0.32)	2.05 (0.16)	4.08 (0.16)
	O1	3.62 (0.23)	1.51 (0.17)	3.18 (1.61)
	P3	2.78 (0.13)	1.36 (0.09)	2.73 (0.2)
Gamma	Fp1	0.63 (0.1)	0.36 (0.02)	0.59 (0.04)
	O1	0.41 (0.04)	0.43 (0.02)	0.40 (0.03)
	P3	0.45 (0.01)	0.40 (0.03)	0.43 (0.06)

believe that the drowsiness often associated with sleep occurs after a regular sleep, while the sleep experience within a meditative practice serves to refresh the individual.

According to Ayurveda, sleep at night has a pacifying effect on *Vata* (excess activity), and a lack of sleep can disturb *Vata*. Conversely, daytime sleep increases *Kapha* (heaviness). However, experiencing a sleep-like state during meditation, as practiced here while sitting in a chair, neither exacerbates *Kapha* nor disrupts *Vata*¹⁶. As such, the sleep-inducing effect observed during meditation, as described in this study, can be regarded as restorative and may aptly be termed ‘conscious sleep.’

We posit that sustained engagement in the mind-body process promotes the integration of mental fragments, resulting in the cultivation of a sense of calmness and relaxation. In EEG signal analysis, we observed an increase in delta power across all three brain regions (Fig. 2.a) during the practice of MBRT. The heightened delta activity, even in brief durations, appears to be an efficient means for napping and facilitating relaxation. Delta wave

production has been associated with processes of rejuvenation, relaxation, and the revitalization of the brain¹⁷. It also contributes to the enhancement of the immune system, natural healing mechanisms, and the promotion of restorative sleep¹⁷.

A prior study on meditation showed an increased frontal delta activity during the meditation process when meditators focused on an object¹⁷. In our approach, we did not involve external objects but rather maintained continuous focused activity. Notably, in the practice of MBRT, which involves attention on thumb movement, we observed a decrease in theta activity, contrasting with the increase observed in anterior theta activity in focused attention (FA) meditation¹⁷. It is important to emphasize that MBRT is distinct from the single-point focused meditation and aligns more closely with a dynamic attention approach.

The prefrontal theta wave, a reliable marker of relaxed wakefulness¹⁹, exhibited elevated activity prior to the MBRT session. However, as the practice continued, the power of the theta wave gradually decreased while the delta wave’s power concurrently increased. Remarkably, within five minutes after the practice concluded, the power of the theta wave returned to its baseline level. These findings suggest that MBRT may effectively satisfy the body’s need for a brief period of restorative sleep. Nevertheless, this distinctive behavior of the theta wave warrants further investigation in extended studies. The alpha wave power increased following the MBRT session, indicating the attainment of a relaxed state¹⁷ through this mind-body approach. Interestingly, the power of beta waves in the prefrontal region displayed similar changes to the alpha waves. Figure 2.b illustrates a reduction in gamma activity within the prefrontal region during the practice. This reduction suggests a calming effect on the prefrontal lobe, potentially leading to a restful and rejuvenating state. Notably, high-frequency gamma waves are typically associated with complex mental functions²⁰, while the prefrontal region is primarily responsible for planning and cognitive thinking patterns²¹. The observed decrease in gamma power during the practice implies that the mind-body relaxation approach may have a role in reducing brain fatigue resulting from intense mental activities. The prefrontal lobe is managing attention, creativity, judgment and voluntary movement²² as well as involved in various high-order cognitive processes,

including decision-making, reasoning, personality expression, and social cognition²³. These aspects could potentially benefit from the application of MBRT, warranting further investigation. It is worth mentioning that the reduced gamma wave activity returned to its baseline levels within five minutes after the practice, indicating an alert and ready-to-engage state. The subjective experiences reported by the participants align with the EEG results of a single participant. However, this study relied on self-reported feedback to gauge the practical effects of the technique, rather than using quantitative assessment-based scales on a larger sample. Future research should consider incorporating such quantitative measures to assess the broader impact of MBRT.

MBRT appears to play a role in enhancing overall well-being in daily life. Delta oscillations, well-known for their association with sleep²⁴, are crucial in this context. Research indicates that delta frequency is a hallmark of slow-wave sleep within the normal sleep cycle²⁵. Notably, the five-minute practice of the mind-body approach has demonstrated the ability to induce calm sleep state. It is worth mentioning that delta waves have broader implications beyond deep sleep. For instance, high frontal delta waves in wakeful individuals have been linked to cortical plasticity, suggesting a role in various cognitive functions. Delta bands are recognized as prominent brain waves, particularly in cognitive processing, as evident in event-related studies²⁶. Therefore, the application of MBRT or any similar approach in a time-efficient manner may significantly contribute to neuroplasticity and cognitive function enhancement.

One significant advantage of this technique is its flexibility, as it does not demand any specific dress code, seating arrangement, or the need for a mat. This makes it accessible to anyone, free from time and space constraints. A practice duration of five minutes has been implemented, which was found to be convenient for participants in classroom settings. However, individuals can adjust the duration as per their personal preferences. Furthermore, this practice does not require any additional equipment or tools, aside from an alarm clock. Contemporary research highlights the manifold positive impacts of meditation on mood, consciousness, and awareness¹⁷. The ancient practices of *Malajapa* and *Karmala* represent as a profound mind-body techniques. Their adaptation as a universal relaxation method represents a pioneering field. In our current study, we have made strides in unraveling the enigmatic elements of these practices through an adapted methodology outlined in this research. The proposed streamlined approach appears to offer ease and

time efficiency, fitting seamlessly into everyday life and even adaptable within workplace settings without the social or mental constraints often associated with the practice of *Malajapa*. Further extensive studies hold promise for uncovering additional insights into the intricate relationship between mind and body. These revelations could potentially offer substantial benefits to society's health and overall well-being.

Conclusion

The suggested mind-body relaxation technique proves to be efficient in swiftly revitalizing individuals. Owing to its simple and time-efficient approach, this method can be adopted by those with limited time for relaxation. In the future, this approach might be helpful for assessing people with restlessness and anxiety.

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Ethical Statement

This is a preliminary, observational study done under purely natural conditions. Tezpur University Ethical Committee has been informed about it. Ref. DoRD/TUEC/10-14(Vol-III) 1124-A.

Conflict of Interest:

Authors have no conflict of interest. □

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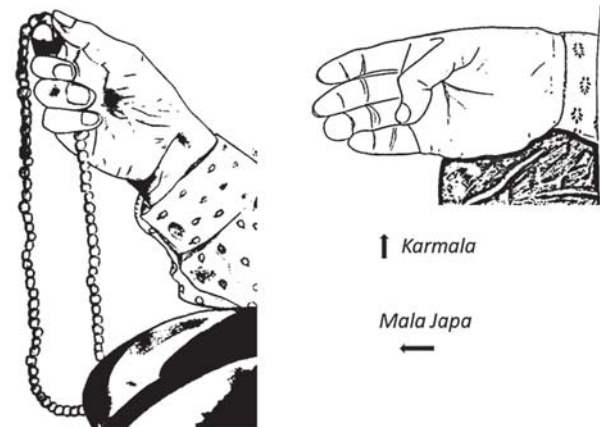
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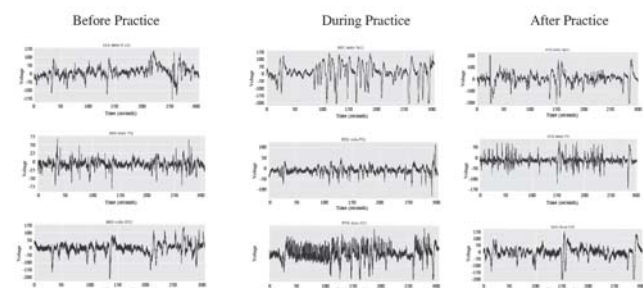
Supplemental Information:

Supplemental Table 1. Representation of responses from 28 participants across times (T1,T2, T3) and categories (sleep, calmness, neutral). T1, T2, and T3 represent the frequency of a participant's performance. Symbols represent- *-sleep, #-calmness, 0- neutral

S.N.	Gender	T1	T2	T3
1	F	#	*	
2	F	#	#	
3	F	*	*	
4	F	*		
5	F	#	*	
6	F	*	#	#
7	F	#	*	#
8	F	*	0	
9	M	*	*	*
10	F	*		
11	F	*		
12	F	*	*	
13	F	*		
14	F	#	*	*
15	F	#	#	
16	F	#	#	
17	M	*	*	#
18	F	#		
19	F	#	#	
20	F	0		
21	M	#	*	*
22	F	#		
23	M	#		
24	F	*	#	#
25	M	#		
26	F	*	*	*
27	F	#		
28	M	#		
Age: 18-30 Years	Sleep	Calmness	Neutral	Total
First time	12	15	1	28
Second time	10	6	1	17
Third time	4	4		08
Total Response	26	25	2	53
PERCENTAGE	49.06%	47.17%	3.77%	



Supplemental Fig. 1. Representation of *karmala* and *mala japa*: A positional view.



Supplemental Fig. 2. Representation of an EEG Signal Collected from three Channels in three Different States.

The sample format (containing 8 items) was used to collect the responses from the participants performing the Mind-Body Relaxation Technique.

Class –

Roll No.-

Age group: ☐ Below 30, ☐ Above 30

Gender- ☐ M, ☐ F

Experience of 5-minute karmala meditation –

1. Slept/slept several times ☐
2. Slept for some time ☐
3. Felt sleepy ☐
4. Remain awake ☐
5. Remain awake but felt calm ☐
6. Closed eyes but not moved thumb ☐
7. Find difficult to keep my eyes close ☐
8. Did not participate ☐

Categorization of items	
Item number	Category
1,2 and 3 choosen single or mutual	Sleep
4	Neutral/No effect
5	Calmness
6,7 and 8 single or mutual	Excluded