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Electroencephalography and heart rate variability prognostics in mental health therapies for Malaysian workers

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ABSTRACT

Globally, over a million individuals succumb to suicide annually, with depression contributing to 6.7% of these tragic deaths. Such crises often stem from life-induced pressures, escalating into severe mental health issues. Recognizing these early signs is pivotal, but insufficient without effective therapeutic measures. This study endeavors to address these challenges by exploring patient responses to therapy using electroencephalogram (EEG) and heart rate variability (HRV) data. Conducted in Kuala Terengganu, Malaysia, the research involves workers and employs aromatherapy, deep breathing exercises, and ruqyah alongside a control group. EEG and HRV signals monitor brain wave patterns and heart rhythm coherence, aiding in identifying depression, stress, and anxiety indicators. Integrating questionnaire data including the depression-anxiety-stress-scale (DASS), beck depression inventory (BDI), beck anxiety inventory (BAI), and statistical analysis, the study aims to evaluate therapeutic efficacy in enhancing relaxation and mental well-being. Metrics like HRV coherence ratio and EEG delta wave activity offer insights into therapy optimization. Results suggest deep breathing exercises and aromatherapy as most effective in inducing calmness, followed by ruqyah. By tailoring therapy to individual needs, especially among workers, the study endeavors to foster mental health resilience in communities, paving the path towards a mentally healthier populace.

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1. INTRODUCTION

Mental health is a significant concern in today's society. Mental well-being includes multiple dimensions, such as emotional reactions, cognitive processes, behaviors, and social relationships. The World Health Organization (WHO) [1] has noted that approximately 25% of Europeans experience mental health issues. In 2021, WHO [1] also noted that there were 190,900 deaths in the European Union resulting from mental and behavioral disorders, accounting for 3.6% of all deaths. Additionally, a 2022 survey revealed that 55% of adults across Europe are at risk of depression, with countries like Poland, Greece, and Cyprus having the highest shares at 65%. Research has consistently highlighted the prevalence of conditions such as

depression, anxiety, and stress among individuals working in service-oriented jobs. According to Wang *et al.* [2], a 2022 report revealed that 57.8 million adults (22.8%) in the US experienced mental illness, 19.4 million (7.6%) had both substances use disorder and mental illness, and 12.3 million (4.8%) seriously contemplated suicide. In Denmark, 71.4% of school leaders showed adequate health literacy, but workload escalation was higher among those with insufficient literacy (81.6%) compared to those with sufficient literacy (66.0%) [3]. Meanwhile, Durand-Moreau *et al.* [4] found inconclusive evidence on the efficacy of mindfulness for improving workers' mental health, highlighting the need for more rigorous and standardized research in this area. Given the widespread mental health issues among workers, it's crucial to extend these investigations specifically to service workers.

Malaysia, like many other nations, faces significant mental health challenges, particularly within service industries, with one in three Malaysians aged 16 and above dealing with mental health issues, according to the Ministry of Health Malaysia. Mohamed *et al.* [5] assessed occupational stress among police officers using police stress questionnaires (PSQ) and found that among Malaysian police officers, 41.1% reported moderate depression, 45% experienced moderate anxiety, and 31.8% underwent moderate stress. The majority of police officers experienced moderate to severe levels of depression, anxiety, and stress during the COVID-19 pandemic. Additionally, Azmi *et al.* [6] examined Malaysia's workplace mental health laws and policies, comparing them with those in developed Commonwealth countries like the UK. Using qualitative and comparative methods, they analyzed the principles and effectiveness of these frameworks. Their study concluded that Malaysia needs a comprehensive legal framework and effective policies to support workplace mental health, learning from the UK's more advanced approaches. Then, Abdullah *et al.* [7] investigated the impact of psychosocial factors (decision latitude, social support, and working environment) on employees' mental health and examined the moderating effect of emotional distress. Analyzing responses from 216 employees in private development companies, their results showed that only decision latitude significantly affects mental illness, while emotional distress does not moderate this relationship. Their study suggested that providing employees with greater decision-making freedom can reduce mental illness and enhance productivity. Muniandy *et al.* [8] assessed awareness and perceptions of mental illness within the Malaysian construction industry, aiming to identify factors contributing to mental health issues among employees and their impact on absenteeism and presenteeism. Using a quantitative approach, their study found that while most construction workers reported stable mental health, there were notable instances of anxiety, stress, depression, and PTSD, particularly among younger, white-collar employees with less work experience and insecure employment. Their research highlighted the need for active attention to mental health by scholars and governmental agencies, with findings showing absenteeism and presenteeism rates of 5.8% and 22.4%, respectively, leading to significant costs. Additionally, burnout was prevalent among Malaysian junior doctors (26.5%) and university academicians (10.7%) [9], underscoring the urgent need for further research to address mental health concerns.

Beyond exploring statistics and the mental health landscape, upcoming discussions will center on therapeutic approaches, including aromatherapy. Xie *et al.* [10] highlighted the benefits of aromatherapy, showing its potential to alleviate physical symptoms, reduce stress and anxiety, and enhance mood. Similarly, Kwon *et al.* [11] demonstrated aromatherapy's positive effects on emotional well-being and fatigue reduction during exercise. In addition to aromatherapy, deep breathing serves as an alternative for managing mental health, as shown by Mahalakshmi *et al.* [12], who found significant stress reduction and anxiety alleviation through deep breathing exercises. An alternative method explored by Ismail and Rofi [13] utilizing ruqyah shows promise in treating mental disorders through spiritual approaches. However, none of these therapies have yet utilized modern devices capable of capturing mental health indicators from both electroencephalogram (EEG) and heart rate variability (HRV).

Recent studies have utilized EEG and HRV devices to detect and analyze various mental health conditions. However, simply relying on early detection is not sufficient to prevent mental disorders [14]. It is crucial to implement effective therapeutic interventions to manage these conditions. Evaluating the progress of patients can be challenging due to inherent biases and diverse theoretical orientations among clinicians [15]–[19]. This research aims to explore patient responses to different therapies, employing EEG and HRV signal data. The therapeutic approach will include aromatherapy, deep breathing exercises, ruqyah, and comparisons with a control group. Therapy sessions and consultations will be held for workers in the Kuala Terengganu region. By utilizing EEG and HRV signals, the research aims to capture brainwave patterns and heart rhythms, enabling the identification of physical indicators related to depression, stress, and anxiety through both visual and auditory methods. The study will analyze findings from standardized questionnaires depression anxiety stress scale (DASS), beck anxiety index (BAI), beck depression index (BDI) collected via an online platform (e-MAST), alongside EEG and HRV data, using appropriate statistical analysis methods. Thus, this research aims to provide a more integrated, objective, and contextually relevant understanding of the efficacy of various mental health therapies among Malaysian workers, consolidating data from DASS, BAI, and BDI along with EEG and HRV measurements [15]–[19].

This paper is structured in the following way: In Section 2, the techniques utilized for capturing HRV and EEG data during therapy sessions are described. Section 3 presents the overarching findings related to demographics, DASS, BDI, and BAI collected from the e-MAST platform. Section 4 offers an analysis of HRV and EEG outcomes from various therapeutic approaches. Lastly, Section 5 reviews the findings of the study and suggests possible directions for future research.

2. PROCEDURE FOR MENTAL HEALTH THERAPY

This section outlines the proposed step-by-step procedure for conducting the research and achieving all the established goals. To accomplish the objectives outlined, the therapy will be conducted in four sequential phases:

– Step 1: Identify the target respondent group and utilize the e-MAST web platform for distributing the questionnaires.

Each respondent will respond to a series of questionnaires designed to evaluate their mental health condition using the e-MAST tool as shown in Figure 1. This process includes two primary sections: PART A, which collects demographic data, and PART B, consisting of a mental health screening assessment based on the DASS 21 framework. Invitations have been extended to 152 companies located in the Kuala Terengganu region, which encompasses service industries in both Kuala Terengganu and Kuala Nerus, Malaysia. Once responses are submitted, the e-MAST system will automatically analyze the results and provide a comprehensive evaluation of mental health status, along with tailored recommendations on the following page.

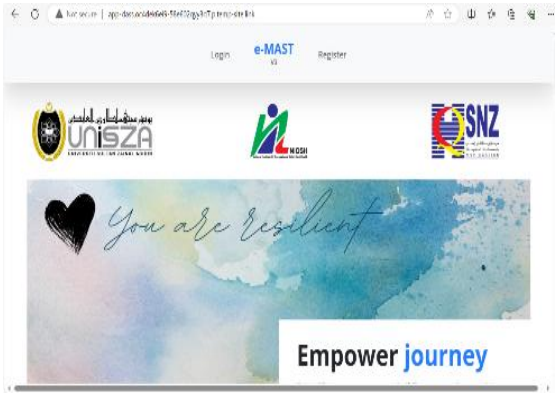

Figure 1. e-MAST web-based platform

– Step 2: Selecting participants based on e-MAST scores

Once respondents submit their assessments, the e-MAST tool will automatically produce results for each individual, delivering a thorough analysis of their mental health and tailored recommendations on the following page. These results will be documented, allowing respondents to monitor their mental health over time. Individuals with scores ranging from mild to extreme mental health concerns will be identified to advance to therapy sessions, during which they will receive comprehensive details along with the 'Research Information Sheet & Consent.

– Step 3: Conducting therapy sessions with the Hospital Sultanah Nur Zahirah (HSNZ) team

Therapy Phase 1: All selected participants will be encouraged to accurately and thoroughly complete both the beck depression inventory (BDI) [20] and the beck anxiety inventory (BAI) [21] as essential parts of the evaluation process. This step is vital for gaining insights into their levels of anxiety and depression, thereby enhancing the overall assessment of their mental health. The BDI and BAI, created by Aaron T. Beck, are respected self-report instruments used to assess the intensity of depression and anxiety symptoms, respectively [22]. Each tool features 21 items rated on a scale from 0 to 3, making them widely applicable in both clinical and research environments for screening, evaluation, and therapeutic planning.

Therapy Phase 2: It is important to carefully attach the EEG and HRV monitoring devices to the participants, ensuring that they are accurately and securely positioned. This will allow for high-quality and comprehensive data collection during the monitoring phase. The devices in use include the 5-channel EEG signal detector, Insight 2, from EMOTIV, and the HRV signal detector, emWave Pro [23], as illustrated in Figure 2. Figure 2(a) presents the EEG device, while Figure 2(b) shows the HRV device.

Therapy Phase 3: Start the process of recording EGG and HRV by carefully setting up the necessary equipment to ensure accurate physiological data collection. Participants were then instructed to take part in a 5-minute resting period, during which they were encouraged to relax fully. This allowed for the establishment of baseline physiological measurements.

(a) (b)

Figure 2. Setup monitoring devices untuk therapy phase 2 for (a) EEG signal detector devices and (b) HRV signal detector devices

Therapy Phase 4: Each therapy session lasts 15 minutes and consists of various modalities, including aromatherapy, deep breathing exercises, ruqyah, and a control group. These sessions are designed with specific interventions tailored to achieve particular therapeutic objectives associated with each method. Aromatherapy incorporates essential oils from natural plant sources to support physical, emotional, and mental wellness, with Gelam Oil from the Melaleuca cajuputi tree being notably significant [24]. The deep breathing technique involves a conscious effort to breathe in deeply through the nose, allowing the abdomen to expand, followed by a slow exhalation through the mouth [25]. This approach aims to encourage relaxation, mitigate stress, and improve overall well-being by stimulating the body's relaxation response. Ruqyah, which is grounded in Islamic practices, includes the recitation of selected Quranic verses for spiritual healing and protective benefits, commonly using Surah Al-Fatihah and Surah Ar-Rahman. Research from Rafique *et al.* [26] has shown that Surah Ar-Rahman can be beneficial in reducing symptoms of depression, while Surah Al-Fatihah has been found to support emotional stability by enhancing neural activity and coordination among neurons [27]. The control group plays a vital role in providing a comparison benchmark, consisting of participants who do not undergo any interventions, thus remaining in regular conditions.

Therapy Phase 5: After completing the assigned tasks or evaluations, participants rest for an additional 5 minutes to allow for brief recovery and relaxation. This rest period helps stabilizes their physiological state. Following the rest, the recording of EEG and HRV concludes. This ensures a complete and accurate representation of the physiological data collected during the rest phase.

Therapy Phase 6: Clear and comprehensive instructions were given to all participants. These instructions emphasized the importance of revisiting and completing the BDI and BAI as outlined in the assessment procedures. This step is crucial for gathering updated insights into their anxiety and depression levels. It ultimately enhances our understanding of their mental health status.

– Step 4: Analyzing HRV and EEG Data

In this phase, we conduct a thorough analysis of the EEG and HRV data to gain valuable insights into the brain's electrical signals and the fluctuations in time intervals between heartbeats. This includes assessing various frequency bands in the EEG, as well as examining both time and frequency features of the HRV data. To facilitate understanding of the conducted research, Figure 3 presents a summary of the processes from Step 1 to Step 4. This includes identifying the respondent group through to the analysis of HRV and EEG data. The following section will delve into the examination of the e-MAST, HRV, and EEG data collected.

3. GENERAL RESULTS ON DEMOGRAPHIC, DASS, BDI AND BAI

We shared information with 157 organizations located in Kuala Terengganu and Kuala Nerus, and 30 of them chose to take part in the study. This led to around 294 participants completing the DASS questionnaire available on the e-MAST platform. From this group, approximately 71 individuals showed moderate to significant levels of depression, anxiety, or stress and were subsequently invited to attend therapy sessions. Individuals with specific medical conditions were not included in this selection. Prior to the start of therapy, participants are required to fill out the BDI and BAI assessments, which are incorporated into the e-MAST software, helping to provide a thorough assessment of their mental health.

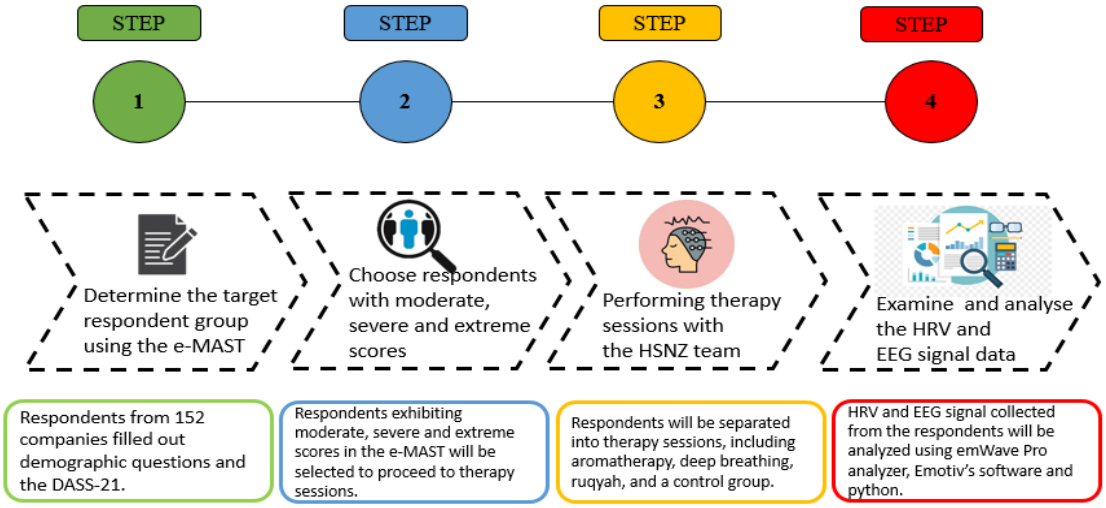

Figure 3. Flowchart of the steps

3.1. Demographic

In this research, data was gathered from 71 participants, including 28 males and 43 females, who completed the DASS assessment and showed relevant symptoms. The gender distribution of the respondents indicated that 39% were male and 61% female. Demographic information was sourced from the e-MAST platform, highlighting the individuals with the highest scores on the questionnaire. Additional details from the e-MAST database will be presented in the following section.

3.2. Depression DASS

The DASS, is a self-report tool utilized to evaluate the severity of symptoms related to depression, anxiety, and stress, as described by Iannattone *et al.* [28]. It contains three distinct subscales: one for depression, one for anxiety, and one for stress, each aimed at measuring the intensity of symptoms linked to these mental health conditions. The DASS is commonly employed in both research and clinical contexts to identify and track symptoms of depression, anxiety, and stress, offering important insights into a person's overall mental health. Figure 4 reveals notable gender differences in the levels of depression Figure 4(a), anxiety Figure 4(b), and stress Figure 4(c) among respondents. In terms of depression, a higher percentage of females fall into the extreme category (14.08%) compared to males (2.82%). Additionally, more males are classified as normal (18.31%) compared to females (19.72%). For anxiety, both genders have an equal percentage classified as normal (14.08%). However, females show higher percentages in the severe (9.86%) and extreme (9.86%) categories compared to males (severe: 1.41%, extreme: 2.82%). Regarding stress, a higher percentage of females are normal (29.58%) compared to males (23.94%). Notably, no males were classified as severe or extreme in terms of stress, while females had 7.04% in the severe and 1.41% in the extreme categories.

These findings suggest that females in the study population experience higher levels of extreme depression and anxiety compared to males. For stress, although females show higher levels of severe and extreme stress, a greater proportion of females are also in the normal category compared to males. This gender disparity highlights the need for gender-specific approaches in mental health interventions and support systems. Following the DASS scale, respondents will undergo subsequent tests, including the BDI and BAI, with their data to be presented in the next section.

3.3. Post BDI and BAI for result comparison

The post-therapy assessments known as the BDI and BAI are conducted after participants have completed a therapeutic intervention. Following their therapy sessions, individuals are asked to fill out the BDI and BAI again via the e-MAST platform. The main purpose of these assessments is to thoroughly assess how effective the therapy has been in reducing symptoms related to depression and anxiety disorders.

Thus, Figure 5 reveals BDI and BAI results where, the post BDI results can be shown in Figure 5(a) and BAI results can be shown in Figure 5(b). The post-therapy results demonstrate significant improvements in depression and anxiety levels among both male and female respondents. A notable proportion of both genders fall into the normal category post-therapy, with females showing slightly higher percentages (41% for BDI and 27% for BAI) compared to males (34% for BDI and 17% for BAI). While males primarily fall into the normal or light categories for depression, females show a more varied distribution, including mild and

moderate categories. For anxiety, both genders are mostly in the normal, light, and mild categories, but females have a higher percentage in the moderate category. These results indicate that the therapies were effective, particularly for females, though some may still need further therapeutic intervention, highlighting the importance of ongoing, tailored mental health support.

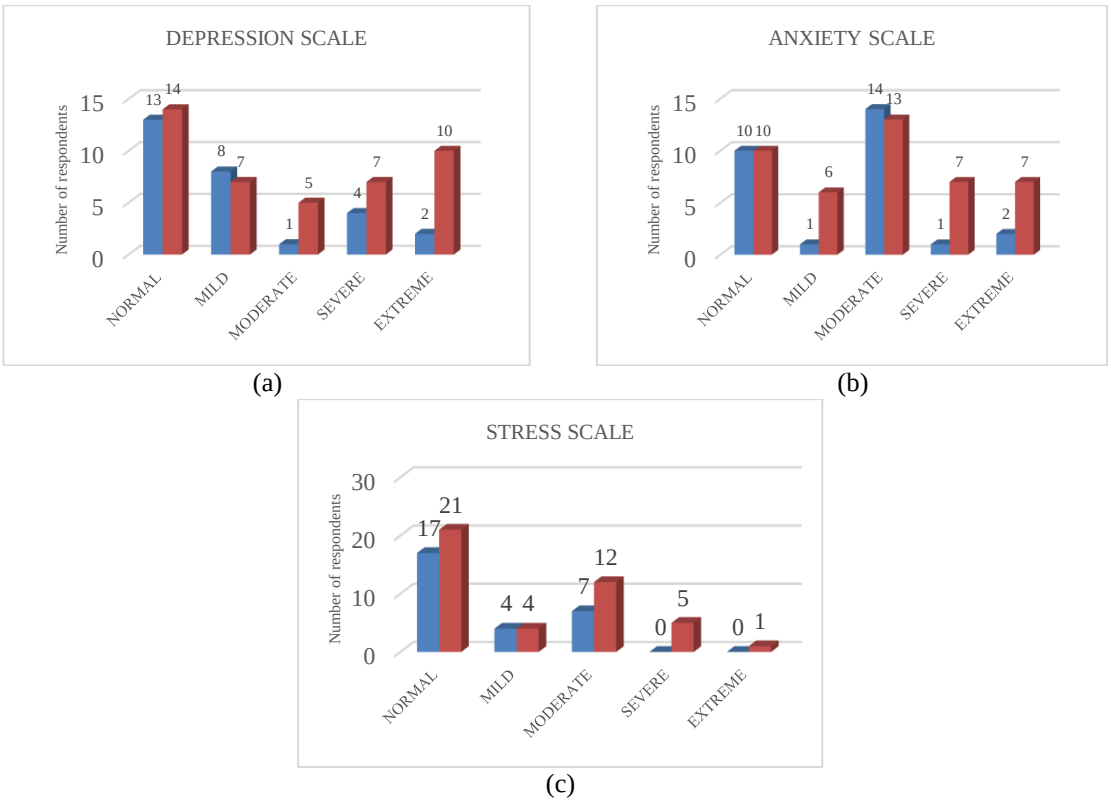

Figure 4. DASS test result for (a) depresion, (b) anxiety, and (c) stress

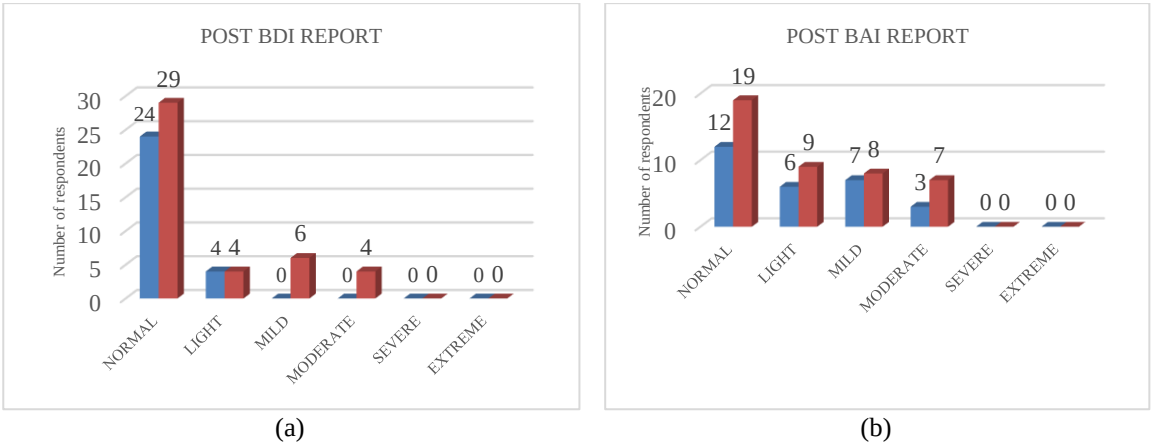

Figure 5. BDI and BAI results for (a) BDI report after therapies and (b) BAI report after therapies

Table 1 summarizes the effectiveness of different therapies in lowering BDI and BAI scores. Aromatherapy and deep breathing therapy resulted in similar average reductions, with BDI scores decreasing by 0.59 and 0.65 points, respectively, and BAI scores by 1.12 and 1.06 points. This led to an overall mean reduction of 1.71 points, reflecting a 26% improvement. Ruqyah therapy achieved a mean reduction of 0.45 points in BDI and 1.15 points in BAI, culminating in a total decrease of 1.60 points, or a 24% improvement. The control group showed reductions of 0.59 points in BDI and 1.06 points in BAI, leading to an overall mean reduction of 1.65 points, indicating a 25% improvement. These results imply that aromatherapy, deep

breathing, and ruqyah therapy are beneficial in alleviating symptoms related to depression and anxiety, evidenced by significant reductions in mean scores. The comparable outcomes of aromatherapy and deep breathing indicate their similar effectiveness in enhancing mental health. Following this analysis of the DASS, BDI, and BAI data, the subsequent section will focus on the findings related to HRV and EEG.

Table 1. Mean score of reducing levels in BDI and BAI tests

Therapy	BDI	BAI	Overall
Aromatherapy	0.59	1.12	1.71
Deep breathing	0.65	1.06	1.71
Ruqyah	0.45	1.15	1.60
Control group	0.59	1.06	1.65

4. HRV AND EEG RESULTS FROM DIFFERENT THERAPIES

The outcomes of therapies that incorporated aromatherapy, deep breathing exercises, ruqyah, and a control group were evaluated through HRV analysis with the emWave Pro software and EEG analysis using eMotiv software. The collected data from these devices underwent additional examination through Python and the MNE library. This facilitated an in-depth exploration of EEG rhythms and provided insights into how the therapies impacted both autonomic nervous system function and brain activity.

4.1. HRV

This segment will evaluate HRV signals gathered throughout the experiment using the emWave Pro software. This tool is specifically crafted for comprehensive analysis of HRV metrics, offering valuable insights into heart rate trends and coherence levels. This analysis aids in enhancing our understanding of autonomic nervous system function and the physiological reactions noted during the study.

Figure 6 presents an HRV result from aromatherapy. The remaining HRV results for other therapies are explained in Table 2. Table 2 presents the data on HRV observations before, during, and after four different therapeutic interventions. The interpretation of the HRV graph relies on coherence level ratios, which fall into three categories: low, medium, and high. According [29], low coherence (red) indicates a lack of synchronization between heart rate variability and breathing patterns, often associated with higher levels of stress and anxiety. Medium coherence (blue) reflects a moderate degree of synchronization, allowing for some level of relaxation and mental clarity. In contrast, high coherence (green) signifies optimal synchronization of physiological processes, linked to lower stress, enhanced cognitive function, emotional balance, and overall wellness. Analyzing the findings from Table 2 reveals notable trends regarding HRV coherence levels across the four therapies assessed. Aromatherapy resulted in high coherence in 80% of the cases during the treatment, with low and medium coherence observed in 10% each. Deep breathing exhibited remarkable results, with 95% of cases achieving high coherence during the intervention, highlighting its significant effectiveness in fostering physiological balance. In the case of Ruqyah, 60% of instances showed high coherence during therapy. The control group, however, maintained a moderate level of coherence throughout the study, indicating that deep breathing stands out as the most beneficial therapy for achieving optimal synchronization and enhancing overall well-being.

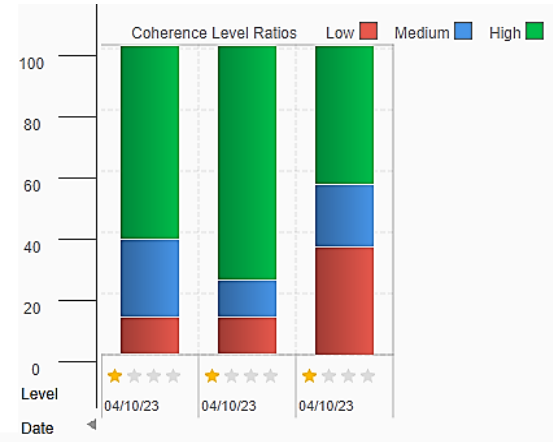

Figure 6. HRV results for aromatherapy

Table 2. Result of HRV reading

Therapy	Before	During	After
Aromatherapy	Low – 40% Medium – 20% High – 40%	Low – 10% Medium – 10% High – 80%	Low – 10% Medium – 30% High – 70%
Deep Breathing	Low – 10% Medium – 20% High – 70%	Low – 0% Medium – 5% High – 95%	Low – 1% Medium – 30% High – 69%
Ruqyah	Low – 60% Medium – 25% High – 15%	Low – 20% Medium – 20% High – 60%	Low – 40% Medium – 35% High – 25%
Control Group	Low – 21% Medium – 10% High – 69%	Low – 18% Medium – 22% High – 70%	Low – 17% Medium – 23% High – 70%

4.2. EEG

This section focuses on examining the results obtained from EEG signals, utilizing both the EmotivPRO Analyzer and Python for analysis. The EEG data underwent processing through the EmotivPRO Analyzer software, which offers in-depth insights into brainwave activity. Furthermore, Python was employed for additional data processing, enabling a thorough investigation of the EEG signals. The subsequent subsections will explore the specific results and interpretations from this EEG analysis, providing an understanding of the neural responses observed throughout the experiment.

Figure 7 displays the EEG bandpower data for delta waves observed during aromatherapy, while Figure 8 shows the EEG bandpower data for delta waves observed after aromatherapy. The other therapies—deep breathing, ruqyah, and the control group—are explained as follows; This data highlights the influences of these practices on promoting relaxation and facilitating deep sleep. Deep breathing therapy shows the highest delta wave bandpower at 18.0 dB, indicating its strong efficacy in promoting relaxation. Aromatherapy also significantly increases delta wave bandpower, suggesting effective relaxation benefits, though slightly less than deep breathing. Ruqyah initially increases delta waves but shows less sustained effects compared to the other therapies, potentially impacting long-term relaxation states inconsistently. These findings underscore deep breathing therapy's effectiveness in inducing and maintaining deep relaxation, offering insights into diverse therapeutic approaches for managing stress and promoting well-being. As a result, the EEG data gathered from the Emotiv device will be analyzed using Python code with the MNE library (MNE-Python). The MNE library, which stands for Magnetoencephalography and Electroencephalography, is an open-source Python tool tailored for the analysis of neuroimaging data, encompassing both EEG and magnetoencephalography (MEG).

An analysis of EEG brain wave patterns observed before, during, and after various therapies, including aromatherapy, deep breathing, ruqyah, and a control group. The EEG analysis reflects electrical brain activity, highlighting beta waves (13-30 Hz) that are linked to alertness and concentration. Effective cognitive processing is indicated when the activity remains below 20 microvolts. The results imply that both aromatherapy and deep breathing show potential for enhancing relaxation and overall mental health, which suggests a need for additional research to explore their effects on mental well-being. The upcoming section will focus on examining the EEG signals to identify the peak duration needed to achieve a state of calmness.

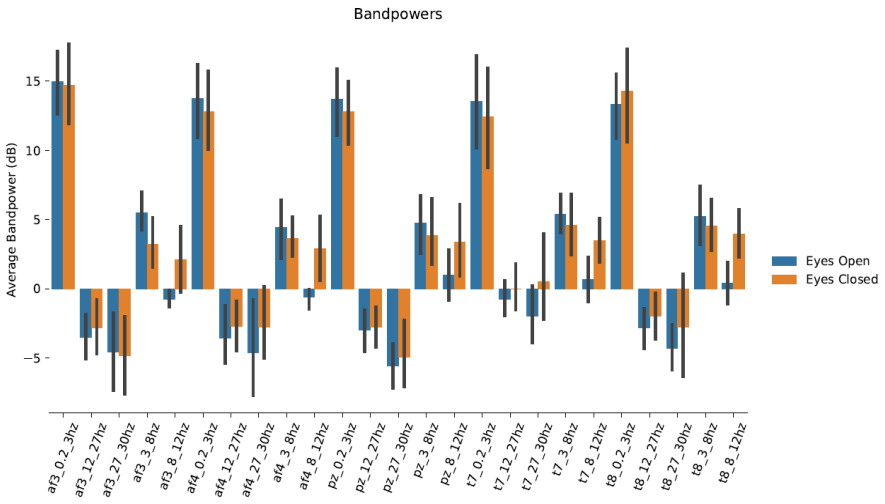

Figure 7. EEG results for aromatherapy (before)

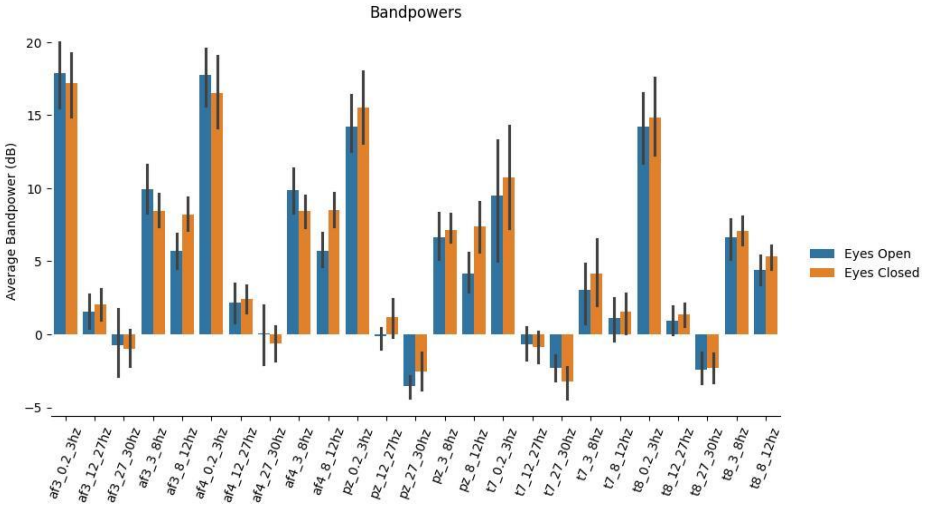

Figure 8. EEG results for aromatherapy (during)

4.3. Maximum time of achieving calmness

Exploring the effectiveness of different therapies in fostering relaxation and tranquility is essential for tackling mental health issues. Notable therapies in this area include aromatherapy, deep breathing exercises, and ruqyah. This study is designed to investigate the time needed to attain a sense of calm through EEG signals for these therapeutic approaches, as well as a control group. The goal is to gain insights that can optimize therapeutic methods and improve mental well-being. According to Wang *et al.* [30], artifacts are defined as any unwanted interference in recorded brainwave activity. These artifacts can arise from various sources, such as muscle contractions, blinking, electrical equipment, and environmental disturbances. To determine when calmness is achieved using EEG, we measure the time between the first and second artifacts, particularly focusing on the longest interval, as illustrated in Figure 9. Our analysis concentrates on each group at the Pz electrode position, following the recommendation of Gao *et al.* [30], which indicates fewer artifacts in this location, thereby facilitating the detection of calmness, characterized by slow brain waves.

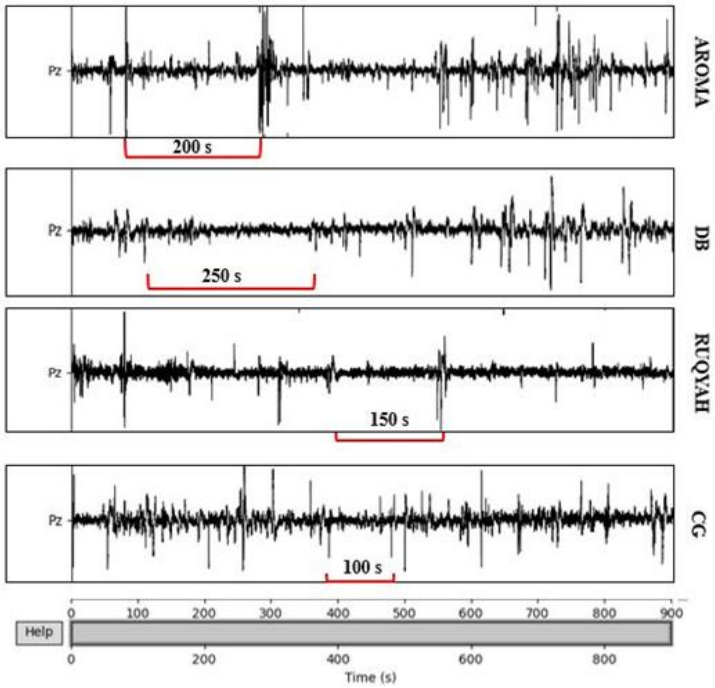

Figure 9. The time for achieving calmness for each group

The findings illustrated in Table 3 indicate that, among the therapies assessed, deep breathing stands out as the most effective method for promoting slow-wave activity, achieving a duration of 250 seconds. This is notably longer than the effects observed with aromatherapy (200 seconds), ruqyah (150 seconds), and the control group (100 seconds). The extended slow-wave activity during deep breathing emphasizes its potency in fostering and sustaining a deep state of relaxation. This prolonged state of tranquility positions deep breathing therapy as a particularly effective technique for encouraging ongoing relaxation and a durable sense of calm.

Table 3. Maximum time achieving slow waves

Therapy	Time (s)
Aroma	200
Deep breathing	250
Ruqyah	150
Control group	100

5. CONCLUSION

By demonstrating the effectiveness of deep breathing, ruqyah, and aromatherapy in promoting calmness and reducing symptoms of stress, anxiety, and depression, our research contributes to advancing therapeutic interventions in mental health management. The proposed different therapies have been shown to significantly reduce symptoms of stress, anxiety, and depression based on EEG and HRV data. Our thorough investigation indicates that deep breathing exercises and aromatherapy are highly effective methods for fostering relaxation among individuals with mental health challenges. The practice of deep breathing consistently results in elevated coherence levels during therapeutic sessions, highlighting its significant role in improving well-being and managing stress. Additionally, aromatherapy is particularly effective in facilitating deep relaxation, as evidenced by the highest power spectral density (PSD) values for delta brain waves. Furthermore, deep breathing exercises have been shown to maintain slow-wave activity for prolonged periods, suggesting their effectiveness in both initiating and sustaining a relaxed state. These results emphasize the value of integrating research-supported relaxation strategies into treatment plans, potentially leading to more holistic and effective mental health care solutions. Implementing these findings across diverse occupational groups and community settings holds promise for improving mental health outcomes beyond traditional clinical environments. Understanding how these interventions can be adapted and integrated into various professional contexts could provide valuable insights into their applicability and effectiveness in real-world scenarios. The identification of deep breathing exercises and aromatherapy as highly effective therapies suggests the need to tailor treatment approaches based on individual needs and preferences. Compared to previous studies, our findings align with the established benefits of deep breathing and aromatherapy, but provide more detailed insights into their effectiveness measured through advanced physiological markers. The strengths of our study include a comprehensive analysis of EEG and HRV data, supporting the high efficacy of these therapies. Future studies could explore the synergistic benefits of combining these techniques within therapy sessions, potentially enhancing their therapeutic impact and promoting sustained mental well-being. Moving forward, further research could explore additional therapeutic modalities and extend the duration of therapy sessions to assess long-term benefits and sustainability. This approach could help optimize mental health interventions and broaden their reach across different populations and settings. In conclusion, our study not only deepens our understanding of effective therapeutic interventions for mental health but also highlights the potential to innovate and improve mental health care practices. By continuing to explore new avenues for research and embracing innovative approaches, we can advance the field of mental health management and ultimately enhance the well-being of individuals facing mental health challenges in our communities.

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