

The Effect of Sufi Breath and Meditation on Quantitative EEG: Is There a Difference?

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Abstract

In this paper, we present a case study with quantitative EEG (QEEG) data to examine the neurophysiological effects of a specific breathing and meditation practice rooted in the Sufi esoteric practices of the Islamic tradition. The practice includes several coordinated cognitive activities. To evaluate the effects of the chosen breath and meditation practice, we compared the functional states of the brain in five frequency (from delta to gamma) bands before and after the completion of a 10-week practice. Statistically significant differences were found particularly in coherence and absolute power scores which are recorded during a no-task state. The increased synchronization and coherence within and between brain regions suggest that changes may be associated with negative entropy quality of spiritual energies. Conversely, the positive entropy has proven to be basis of many mental and physical disorders such as depression. This brain exercise helps permanently reshape the functional connectivity in the brain in a more neurologically conducive way.

Key Words: breath, meditation, quantitative EEG, QEEG, sufism

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Introduction

Although knowledge of the effects of mental states on physical health was common practice in many ancient cultures, this relationship has been superseded by evidence-based medicine and pharmaceutical treatments. However, in recent years, with the rise in mental health disorders, the effects of spiritually themed methods and techniques on health have started to gather attention.

Although many factors such as an increasingly digitalized world, substance intake, stress, and air pollution are among the reasons for the increase in mental disorders. Techniques that cover the body and

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mind have begun to be recommended as alternative treatment methods. Examples of these spiritual techniques include Buddhist compassion practices and transcendental meditation.

The human brain is a vast network of connected pathways that communicate through synchronized electric brain activity. The synchronized activity within some networks is needed for the brain to function in a healthy conducive manner to allow for the processing of certain types of information. Sometimes these activations are linear and yet at other times these connections can be simultaneous. Neurological disorders or tumors can distract disrupt this simultaneous activation (Bowyer, 2016). In this study, the effects of Sufi breathwork (*dhikr*) and meditation, on the brain and general health, are examined as changes may be associated with negative entropy quality of spiritual energies. Negative entropy indicates that the system is becoming less disordered or more ordered. As all living organisms are inclined towards homeostasis and balance, an increase in coherence is used as a biomarker for an increase in negative entropy which has been proven to improve mental and physical health.

Stages of Sufi Breath and Meditation

The purification of the heart is a dominant theme in Sufi literature, as the development of a balanced *personality* is seen as the foundational basis upon which sound mental health—and resiliency depend. All esoteric traditions talk about renewal where man awakens from all the accumulated ideas & experiences. The activation of this spiritual personality requires bodily worship and exercises as well as various moral codes of conduct and behavioural patterns.

This renewal process is what is called meditation, requires listening to a quiet place within. Although it can be formally through physical attunements such as prayer, Sufi breathwork and meditation techniques are commonly used to train the mind. These positive emotion-focused techniques help individuals to learn how to create and sustain a beneficial functional mode known as psychophysiological coherence, characterized by increased emotional stability, and synchronization and harmony in the functioning of physiological systems (Rollin *et al.*, 2009) in everyday life.

As part of this research, our aim was to observe the effects of this mind training on the power of brain waves as well the coherence, which is the synchronization of brain networks, effecting overall mental wellbeing. Sufi breath and meditation are composed of the following few steps (Khan, 1925):

Breath: The process of actively focusing on one's breath. Breath plays a fundamental role in synchronization and integration, because in Sufism all the scattered elements or parts of man can be brought together only through a specific kind of prayer involving a bodily

turning movement called *dhikr*, and breath. Pir Vilayet Inayat Khan (Khan, 2019) once stated that by constantly moving away from the center of human existence towards the periphery, attention is diverted towards the events and circumstances of one's external life. In order for a person to manage their reactions and tendencies, they must turn their attention to the inner world (Kucuk, 2009). In order to have this opportunity, attention should be directed inwards through breath and *dhikr*, the remembrance of God, which are the-main Sufi methods for requesting divine help and support.

Concentration (with silent dhikr): The person's mental repetition of a divine name / attribute. This is the same as in the Yogi tradition when they repeat mantras.

The second step in Sufi meditation is to combine this focused concentration with breath. This ensures focusing of the mind and synchronization with the body. Traditionally, Sufism divides *dhikr*, remembrance of God into two; verbal *dhikr* and *dhikr* of the heart (Geels, 1996). Verbal *dhikr* is a method of repeating divine names or words out loud (*dhikr*) or internally in silence (*fikr*). The act of 'remembering' is not static. A person constantly enters into connection of a stream of divine power. In our Sufi breath practice, we combined the *dhikrs* of the divine names 'Allah' and 'Hu'. 'Allah' (the name of God that encompasses all divine names and attributes) during the intake of the breath and 'Hu' at the outbreath in silence.

Contemplation: The process of imagining/visualizing the beloved, while actively repeating the divine names. There are different methods of contemplation. Contemplation is a neural exercise to stimulate neural networks that help the subject to forget their personal sense of bodily/psychological self. By contemplation on an object, person or subject, the person tries to achieve a way of feeling or sensing beyond their physical or personality boundaries (Hava, 2017). This process would help them expand their consciousness beyond the limited self or body. In this step, it is important to awaken feelings of love, respect or peace of mind. These can be achieved through contemplation of a beloved teacher, (murshid) or any saints or prophets by visualizing their presence, and feeling them as the beloved.

Meditation: The process of waiting in a mentally passive state. Inayat Khan said that "*Meditation is a training of the mind, not in activity, but in a passive state. The aim of training the mind and brain is to lay the groundwork for inspiration, power or blessing from within. So, meditation is very important for Sufis to achieve spiritual attainment.*"

For Sufis, meditation aims to integrate higher dimensions of consciousness (called soul) with their *outer or worldly personality*. At this stage, it is aimed to reflect this transpersonal dimension of being into our ordinary cognition or perspective (Spiegelman, 1994).

People actually reach these subtler unconscious dimensions when the conscious mind is at rest, that is, mostly during sleep. Sufis try to reach these higher dimensions through contemplation or meditation (Spielman & Khan, 1993). In the book of Jungian Psychology and Sufism, spirituality is explained as a process of investigation, worship, and creativity. It is explained that if a person is kept on the threshold between sleep and wakefulness, images will appear in the imaginary mind screen in a way that expresses the inner state of mind through subconscious symbols. This screen can be visual as well as intuitive, and the sense of the Divine or delusions can be felt as well.

At the highest level this can be called unity consciousness, or attaining the state of 'non-dual awareness' (NDA). NDA has been described as a plain and expanded level of consciousness (Austin, 2009). It is also stated that at this level of consciousness one can be aware of the space inside and outside of the body as a unified field of existence (Kjaer, 2000). An 'effortless state of being with indifference and detachment as described by Pir Vilayat Inayat Khan.

In non-dual awareness there is no fragmenting the field of experience into antagonistic poles, such as inside versus outside, self-versus the other, good versus bad, and consciousness versus matter. In terms of brain cortical organization, this dual fragmentation of human consciousness is reflected in the segregation of brain networks into two parts: intrinsic and extrinsic networks which work in an anti-correlative manner even at rest.

Josipovic presented in his research that in this ND consciousness level, the anticorrelation of extrinsic and intrinsic networks decrease. In fact, it has been observed that during NDA these two cortical neural systems become more unified, increasing the functional connection between them. It has been proven that the neural connections from precuneus area is the main cause of different states of consciousness (Boly, 2011) and maximum activation is recorded in this same region during lucid dream (Dresler, 2012).

Realization: The person's transition to different levels of consciousness without their will or any intervention. Since this stage is involuntary, it may not always take place. During contemplation and meditation, the individual must release the control of their mind and passively surrender their will power and intellect to have access to a different state of consciousness and realization. This is the place of 'unknown' which is in fact the 'renewal' state. Returning the consciousness from day to day.

At this renewal stage, all the accumulated neural connections through ideas or beliefs are renewed. It can be argued that through meditation, regular rhythm and parallel neural connections, brain coherence increases and spreads to the whole brain. As the brain and body act as an antenna, this synchronization of neural networks

may provide the possibility for accessing to different thoughts and information which are coming from more coherent magnetic fields (Ahamed, 2015).

In our research, we tried to observe the effects of this renewal in brain with quantitative electroencephalography (QEEG). As the recordings are done in non-task stage, the recordings showed the more permanent effects of this technique.

Method

Research Model

Research was conducted on independent individuals, who have practiced Sufi breath and meditation for 15-20 minutes every day for 10 weeks. Every week via online zoom classes, the Sufi breath was practiced all together. At the beginning, quantitative EEGs of the individuals were taken at a neurological university hospital during the resting stage. After 10 weeks of exercise, brain mapping was taken again with quantitative EEG. The findings were reported by comparing the FFT absolute power and coherence measurements in each individual brain map. Participants consisted of 3 men and 10 women aged between 27-50, without a regular practice of any meditation technique. The selection criteria included individuals without any known psychological or neurological disorders, or previous psychiatric drug use. A well-known and common Sufi breath and meditation method was used, as per teachings taught by a popular Sufi school of thought.

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Data Acquisition

A quantitative EEG (qEEG) was taken before the volunteers started the practices. After 10 weeks of practice and exercises, qEEGs were taken again from the same participants. Quantitative EEG in the conventional EEG graph was obtained from the conventional EEG recordings which were reflected to color-coded physiological brain maps through a special computer program. EEG's were recorded at 125 Hz during 3 min intervals with patients at rest with eyes closed, using 19 electrodes (Fp1, Fp2, F3, F4, C3, C4, P3, P4, O1, O2, F7, F8, T7, T8, P7, P8, Fz, Cz, and Pz) placed on the scalp based on the international 10-20 system. EEG data was collected through "Neuroscan/ Scan LT" neuro-headset (Neuron-Spectrum-3 19-channel Clinical Diagnostic EEG System), which saves EEG signals from 19 channels of the headset, and the electrodes were marked as Fp1, Fp2, F3, F4, C3, C4, P3, P4, O1, O2, F7, F8, T3, T4, T5, T6, FZ, CZ, PZ based on the international 10-20 system of electrode placement. Subjects were asked to stay in a relaxed state, awake and with eyes closed during EEG recording.

FFT Power Amplitude and Coherence Values

Four EEG power band frequencies were used to measure the transition to different levels of consciousness: delta-(1-3.5 Hz), theta - θ (4-7.5 Hz), alpha- α (8-11.5 Hz) and beta- β (12-23 Hz). EEG synchronization and coherence between electrodes were measured throughout different areas of the brain. Functional synchronicity can be evaluated whether different parts of the brain are functioning together. Synchronization can be thought as firing of a very wide neural network at the same time. Among the quantitative EEG measurements, coherence can be considered as to whether the relevant brain regions to which the electrodes are connected, establish an effective connection synchronously. High coherence refers to high connectivity and weak coherence to low connectivity. High connectivity between brain regions shows functionally and structurally connecting and sharing information (Bowner, 2016).

Data Analysis

The quantitative EEG results obtained in the study were transferred to the computer environment and obtained by applying the Wilcoxon test in the SPSS 26 Software. The absolute power and coherence values before and after the 10-week program are compared. The analysis was conducted by an independent research assistant employed at Uskudar University, Istanbul.

Results

13 people participated in the study. 30.8% ($n = 4$) of the participants in the study were male and 69.2% ($n = 9$) were female. The average age of the participants in the study is 42.19 (SD = 7.48). The minimum age is 27 while max age is 53. As the data from qEEG results were too many, we had selected a total of 194 electrode measurements and 2496 data from before and after results of 13 individual to evaluate and compare the results. In this respect, only temporal lobe and center electrodes for Absolute Power results are evaluated in line with the previous research results on different meditation techniques.

On the other hand, for evaluation on the changes of the coherence biomarker, we have compared the temporal lobe regions between T3-T5 and T4-T6 electrodes in the intra hemispheric areas. In interhemispheric electrodes, we have analyzed homologous electrode pairs of FP1-FP2; C3-C4; O1-O2; T3-T4; F3-F4; P3-P4; F7-F8; T5-T6 in all frequency band.

FFT Absolute Power Values

A statistically significant difference was found between pre-test and post-test values of T6 (right temporal lobe) both for Beta1 and Beta wave bands ($p=0.046$ and $p=0.055$) for FFT Absolute Power measurement. There is an increase in the post-test values compared to the pretest values in T6 beta and Beta1 waves.

Comparison of Coherence Values

T3-T5 (left temporal lobe) Alpha wave shows an increase in the post-test values compared to the pretest values ($p=0.023$). Likewise, there is an increase in the post-test coherence values in T3-T5 Beta wave compared to the pretest values ($p=0.023$). A statistically significant difference was found between pre-test and post-test results of T4-T6 (right temporal lobe) Beta and Alpha brain waves. In T4-T6 Beta wave, there is an increase in the post-test coherence values compared to the pretest values ($p=0.046$). In the T4-T6 region, for Alpha brain wave, we have found a moderate increase in the post-test values ($p=0.055$). In F7-F8 régions, there is a significant decrease in the post-test coherence values of the Delta brain wave values compared to the pretest values ($p=0.019$). Similarly, in F7-F8 region, there is a decrease in the theta post-test values compared to the pretest measurement ($p=0.023$). There is a statistically significant increase in the brain wave in post-test values compared to the pretest coherence values in T5-T6, left temporal lobe beta wave ($p=0.046$).

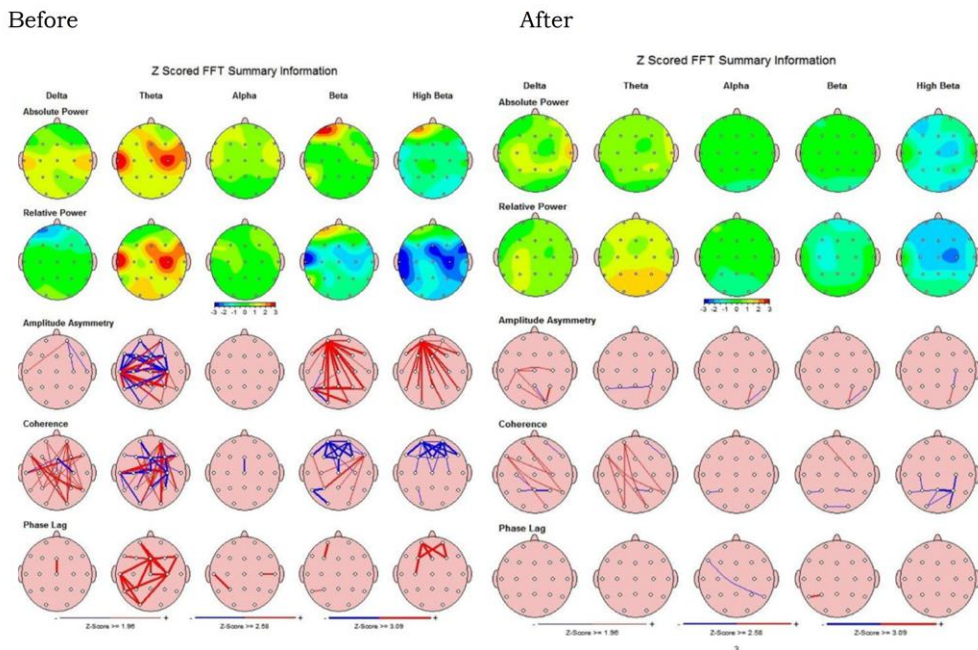


Figure 1. The Brain Map of R.K. Before and After the 10-week Meditation: Change in Theta Waves & Balanced Coherence.

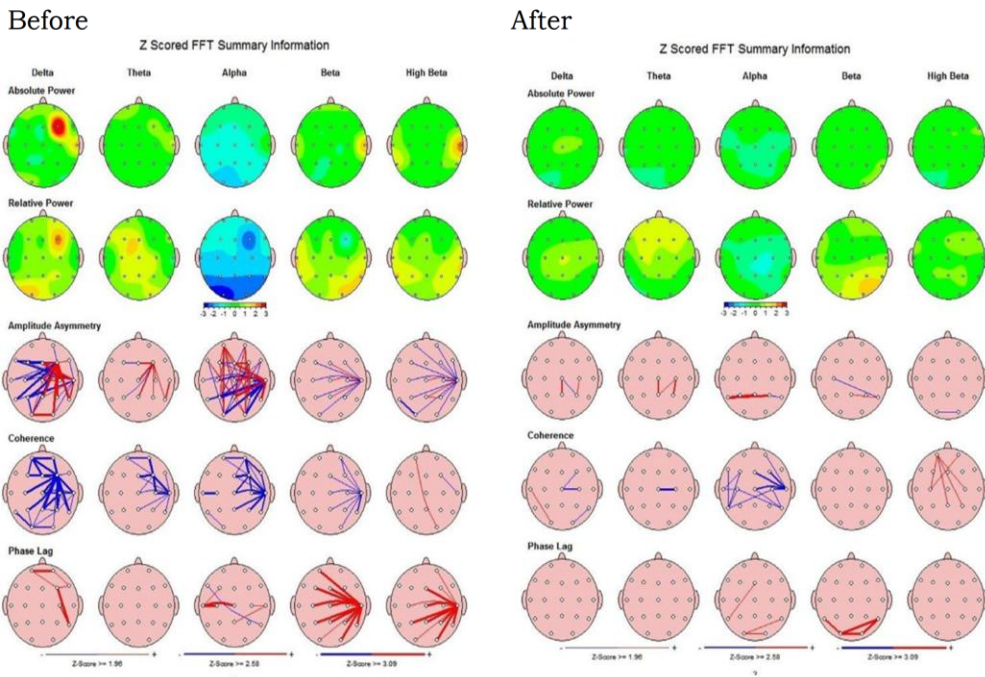


Figure 2. The Brain Map of F.G Before and After 10-week Sufi Breath Practice: Asymmetry Balanced.

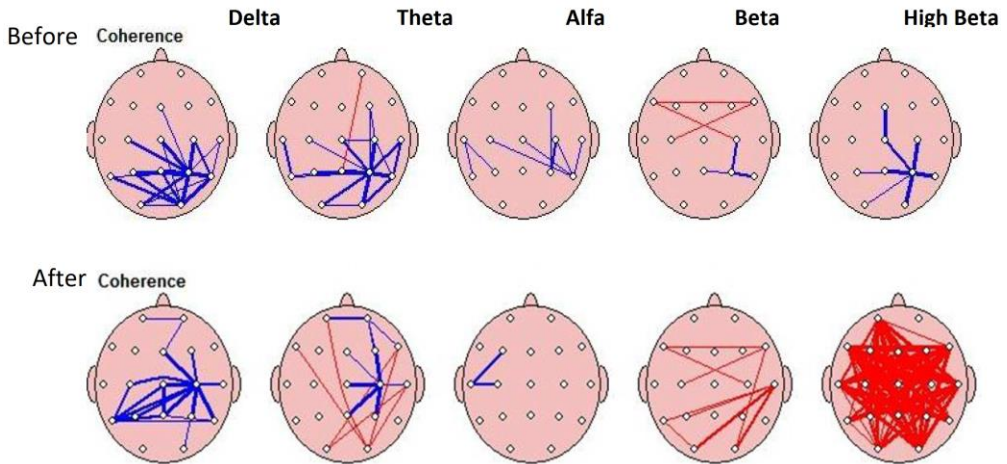


Figure 3. Quantitative EEG Brain Map Sample of case BPT: Increase in Coherence, as arrow.

Discussion and Conclusion

Science aims to understand the presence of spiritual energies by measuring their secondary effects on the biology through changes in enzymes, or on physical matter through their effects on crystallization, or via psychology through changes in behavior or electromagnetic fields through changes in vibrations. In this research, we tried to observe the effects of spiritual energies through the changes in

coherence, which measures the harmony and balance of the biological systems.

While coherence has been used in clinical studies as a discriminative measure in diseases of the nervous system, the synchronization and harmony generated in the coherent state has been used to explain many of the reported psychological and physiological healthy states.

Clinical research has shown, for example, in patients with Alzheimer's disease, the most common biomarker is decreased coherence especially in alpha and beta brain waves (Adler, 2003). Similarly, a reduction in delta and theta coherence is associated with psychological disorders such as depression, anxiety or emotional imbalances (Bowyer, 2016).

So, given the importance of coherence on clinical cases, the improvement on the coherence measure as per the results we shared above can be regarded as beneficial effects of Sufi breath and meditation for maintaining mental health. Regular practice of Sufi breath and Meditation seem to bring negative entropic properties that move brain waves towards order and harmony at even cellular level (Gerber, 2008). In terms of improving mental health, it is shown that the increase in coherence in beta waves in the frontal and temporal brain regions, result in an increase in the efficient functioning of the working memory (Gross, 2008) enhanced concentration and focus (MahdiNejatJamal-e-Din & Azameti, 2020).

Another significant effect of increased coherence is its effects on general intelligence. Evidenced by scientific researches, high coherence is directly proportional to high overall intelligence (Lee, 2012). Studies show that synchronous functioning of the brain, the harmonious firing of simultaneous nerve cells, increases the power of intelligence and creativity. Spiritual intelligence, which can be defined as a higher and more comprehensive understanding of any issue, is a result of both brain hemispheres working together harmoniously.

The most necessary 'sports' of the future may be exercises aimed at bringing the brain and nervous system to high and harmonious frequencies. Sufi breath and meditation, which unites many ancient wisdom techniques, is recommended to be one of these exercises. Studies on *dhikr*, breath, *muraqabah* and *rabita* practices specific to the tradition of Islam are very limited. More comprehensive studies need to be made on such practices that can be applied in daily life. The practices belonging to the Sufi tradition, also resemble many ancient wisdom techniques of Eastern cultures. As seen in comparison, this technique can be seen as a method uniting all in each step. The effect of increased and synchronized brain waves on cellular basis or on enzymes and hormonal system is a subject that needs researching further.

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