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Theoretical Analyses

Survey on Om Meditation: Its Effects on the Human Body and Om Meditation as a Tool for Stress Management

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Abstract

Meditation and yoga both have positive effects on physical, as well as mental health. Om mantra chanting, a simple and easy to practice, also comes under the aspect of meditation. The “Om” mantra is also considered as the very name of the absolute. Om meditation not only affects the various parts of the brain, such as pre-frontal cortex, vagus nerve, amygdala and others but also affects the heart rate and respiratory rate. Considering the healing effects of Om meditation, through this paper, we are trying to explore all the relevant work done in the field of Om meditation. The survey includes a large number of papers covering the research previously conducted by many researchers, their results and different techniques adopted to study the effect of Om meditation on human beings. Studies on Om meditation are categorized under four different heads: Neuroimaging studies, EEG studies, evoked potentials studies and other methods studies. Even though the existing research evidenced capability of Om meditation in curing anxiety and depression, more rigorous studies with better design, with larger sample size and with different control groups are required. Especially the need to explore untouched research areas of Loud Om meditation using EEG is suggested in the paper. Furthermore, future research directions are also suggested.

Keywords: EEG, pre-frontal cortex, vagus nerve, amygdala

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Stress, a word formerly coined by Selye, is defined as “the non-specific neuroendocrine response of the body” (Szabo, Tache, & Somogyi, 2012). Stating the medical, social and philosophical importance of stress, Hans Selye has termed stress as the most meaningful subject for humanity (Szabo et al., 2012). Technically stress is classified as Eustress termed as positive stress, Neustress and Distress (Thapliyal, Khalus, & Labrado, 2017). Distress further leads to chronic stress (Thapliyal et al., 2017) which, if poorly managed may lead to more serious illnesses (Sharma, Dhall, Gedeon, & Goecke, 2013). Stress may arise due to a number of reasons which can include the inability to cope with work pressure, economic conditions or family issues (Smitha, Xin, Lian, & Robinson, 2017). Everyday stress may lead to adverse conditions such as anxiety, fear, anger, depression or social frustrations (Perera, Perera, Rathnarajah, & Ekanayake, 2017; Sharma et al., 2013). Long term effects of stress may affect the heart and brain functions (Chandra, Jaiswal, Singh, Jha, & Mittal, 2017). A number of studies conducted in the last decade indicate that use of yoga and meditation may reduce levels of anxiety and

depression and facilitate better states of relaxation which are conducive to better mental and physical health (Ahani et al., 2013).

Yoga is the spiritual science that is considered as omnipresent, unsectarian and unaltered phenomena (Madanmohan, 2008). Meditation is one of the aspects of yoga that can be stated as consciously and voluntarily guiding one's self-attention for relaxation or for seeking oneself or for personal improvement. Meditation can be categorized into two types: first type involves focusing attention on a particular object and second being mental or loud repetition of a chant called as mantra meditation (Schmidt & Walach, 2014). Varieties of mantras can be chosen for meditation. Mantra repetition is a simple method to implement in order to attain meditation (Burke, 2012). The appearance of an Om syllable in the Upanishads, Bhagwat Gita and Vedas make it holy and sacred (Kumar, Nagendra, Manjunath, Naveen, & Telles, 2010) thus making it the highest sacred symbol in Hinduism. Om, considered as the name of God, is a sacred syllable in Hinduism from which all other sound came into existence (Kumar et al., 2010).

Om singing is based on the generation of vibrations that propagate bottom-up through the body (Kalyani et al., 2011). Vibrations are generated by the successive uttering of simple basic sounds A-U-M that do not require involvement of the tongue. Om mantra can be chanted out loud or internally. When it is chanted out loud, the sound of the mantra becomes the focus of your attention. Saying the mantra aloud is said to help accustom yourself to the pronunciation of the mantra, as well as calming your mind. Mantras chanted mentally are the most powerful (Taimini, 1986). But mental repetition is said to require a great level of focus and attention to keep your mind pointed on your mantra (Goel, 2018). The author (Goel, 2018) suggests that it is good way to begin with loud mantra meditation.

Many studies on this mantra meditation have been conducted since 1994 (Telles, Nagarathna, Nagendra, & Desiraju, 1994). Mainly these studies were based on mental repetition of Om mantra which revealed that Om meditation leads to physiological awareness, and increased sensitivity (Kumar et al., 2010). EEG has a wide range of applications in research field since it contains a lot of pathological and physiological information (Liu, Yan, Zeng, & Wang, 2010). EEG signals are used as a tool to examine mental states, to find the effects of meditation (Harne, 2014). But neurophysiological changes from loud Om mantra meditation, are yet to be fully explored.

The syllable of 'Om 'consists of the three phonemes - A, U, and M. "A" represents the physical plane. "U" represents the mental and the astral plane, the world of intelligent spirits, and all heavens. "M" shows the deep-sleep state (Sivananda, 2010). The vibrations of Om flow from the belly to brain, and these sound vibrations have a great impact in harmonizing our body (Dwivedi & Singh, 2016).

Scope of Om Meditation

Nowadays stress is more persistent than ever because of the accelerating pace of modern life and constant change. It is a well-established fact that stress hinders memory, concentration, judgment and decision-making (Moss & Hammond, 1991). Relaxing effects produced after Om meditation can be brought by any other techniques of meditation as well (Cahn & Polich, 2006). Since Om meditation is easy to practice, it needs less time, as well as does not require expert or trainer to assist while performing; it has advantages over other meditation techniques. The purpose of this review paper is to explore the existing experimental studies on Om meditation be it loud, mental or listening Om in order to find the effects of Om meditation on the human body.

This paper is an attempt to systematically review the available studies on Om meditation, to determine how the studies have been done and to find the benefits of Om meditation so far explored. Many researchers have found the effects of Om meditation on human beings by analyzing various parameters such as Electroencephalograph (EEG), neuroimaging, Evoked Potentials and other methods (Bhargav et al., 2016; Das & Anand, 2012; Deepeshwar, Vinchurkar, Visweswaraiah, & Nagendra, 2015; Harne, 2014; Kumar, Guleria, & Khetrapal, 2015; Kalyani et al., 2011; Telles, Nagarathna, & Nagendra, 1995; Telles, Nagarathna, & Nagendra, 1998; Telles et al., 1994; Gurjar, Ladhake, & Thakare, 2009). This review could work as a platform holding analysis of the previous studies, as well as providing directions for future research in Om meditation. To study the effects of Om chanting on human being, the study is divided, according to four different criteria depending on the parameters used to analyze the effect of Om meditation. The four criteria are listed below:

1. Om meditation studies using neuroimaging methods
2. Om meditation studies based on EEG methods
3. Om meditation studies using middle latency response (MLR) method
4. Om meditation studies using other methods

Om Meditation Studies Using Neuroimaging Methods

Table 1 summarizes the findings of studies on Om meditation based on neuroimaging method.

Table 1

Om Meditation Studies Using Neuroimaging Methods

Om chanting type	Subjects	Type of meditators	Method / Signal Processing	Experimental Design	Findings
Bhargav et al. (2016)					
Loud Om chanting	20	naïve	Functional near-infrared spectroscopy (fNIRS)	Subject exposed to mobile phones (30 min) → Om chanting (5 min)	Deactivation of pre-frontal cortices due to the vibrations produced by the sound 'Om'; Study suggests that Om chanting may have a stimulating effect on branch of vagus nerve in the ear canal.
Kumar, Guleria, & Khetrapal (2015)					
Listening Om mantra	21 (All male)	-	Functional magnetic resonance imaging (fMRI)	Listening OM (12 ms) → No sound (12 ms) → Listening AAM (12 ms) → No sound (12 ms) → Listening TOM (12 ms) → No sound (12 ms)	Neural regions activated during listening to "Om" sound in contrast to non-meaningful word (TOM); The common activated region DMFC supports the emotional empathy of "Om" sound, while SMG implicates phonological processing of "Om" syllable.
Deepeshwar, Vinchurkar, Visweswaraiah, & Nagendra (2015)					
Mental Om mediation	22 (All male)	Experienced	fNIRS	Random thinking → mental chanting and effortless defocusing on syllable "Om"	Oxygenation levels are increased in the PFC during meditation

Om chanting type	Subjects	Type of meditators	Method / Signal Processing	Experimental Design	Findings
Kalyani et al. (2011)					
Loud Om Chanting	12	4 experienced and rest naïve	fMRI	15 Seconds REST → Om 15 Seconds → REST 15 Seconds → SSSS 15 Seconds	Significant deactivation in the amygdala, anterior cingulate gyrus, hippocampus, insula, orbitofrontal cortex, Para hippocampal gyrus and thalamus during 'Om' chanting. It suggests that Om chanting can be another therapy in depression and epilepsy

Note. DMFC = Dorsal Medical Frontal Cortex, SMG = Supramarginal Gyrus, ms = millisecond, PFC = Pre Frontal Cortex, AAM and TOM and SSSS = any random sound other than Om selected by author, REST = rest state as defined and used by author in respective study.

Functional magnetic resonance imaging (fMRI) and functional near-infrared spectroscopy (fNIRS) were used to compare and evaluate the effects of Om meditation by the following four studies. From the studies on neuroimaging (Bhargav et al., 2016; Deepeshwar et al., 2015) pre frontal cortex (PFC) area of the brain is seen to be affected wherein deactivation and oxygenation of PFC is observed which lead to the conclusion that the vibrations produced by Om meditation has relaxing effects. The authors (Bhargav et al., 2016) specifically point out stimulating effects of Om meditation on a branch of the vagus nerve. They also presented future research directions in this study with larger sample size and advanced stroop methods with reaction time along with Stroop performance scores. Studies comparing Om syllable with neutral syllable (Kumar et al., 2015) show that neural regions such as bilateral cerebellum, left dorsal medial frontal cortex and right supramarginal gyrus activate during listening to “Om” sound. Further stating that DMFC holds the emotional affinity of “Om” sound, whereas SMG suggests lingual processing of “Om” syllable. The confounding effect of Om meditation is observed in an FMRI study (Kalyani et al., 2011) that shows that meditation has a sign of relaxation. Indeed, the authors imply that Om meditation can be used as a therapy for people affected by anxiety and suffering from depression.

Om Meditation Studies Using EEG Methods

EEG signal as a neurological and psychiatric diagnostic tool was firstly used and discovered by a German psychiatrist Hans Berg in 1929 (in Tudor, Tudor, & Tudor, 2005). Table 2 summarizes the findings from EEG Om meditation studies.

Table 2

Om Meditation Studies Using Electroencephalogram (EEG) Methods

Om chanting type	Subjects	Type of meditators	Method / Signal Processing	Experimental Design	Findings
Harne, 2014					
Loud Om mantra chanting	10	Naïve	Time domain Analysis (Higuchi Fractal Dimension (HFD))	Rest → Om Chanting → Rest	Om chanting reduces the complexity of EEG signal.

The study suggests that Higuchi fractal analysis reveals that EEG complexity reduces after loud Om meditation and also states that a feeling of calmness is achieved (Harne, 2014). This study suggests that this analysis can

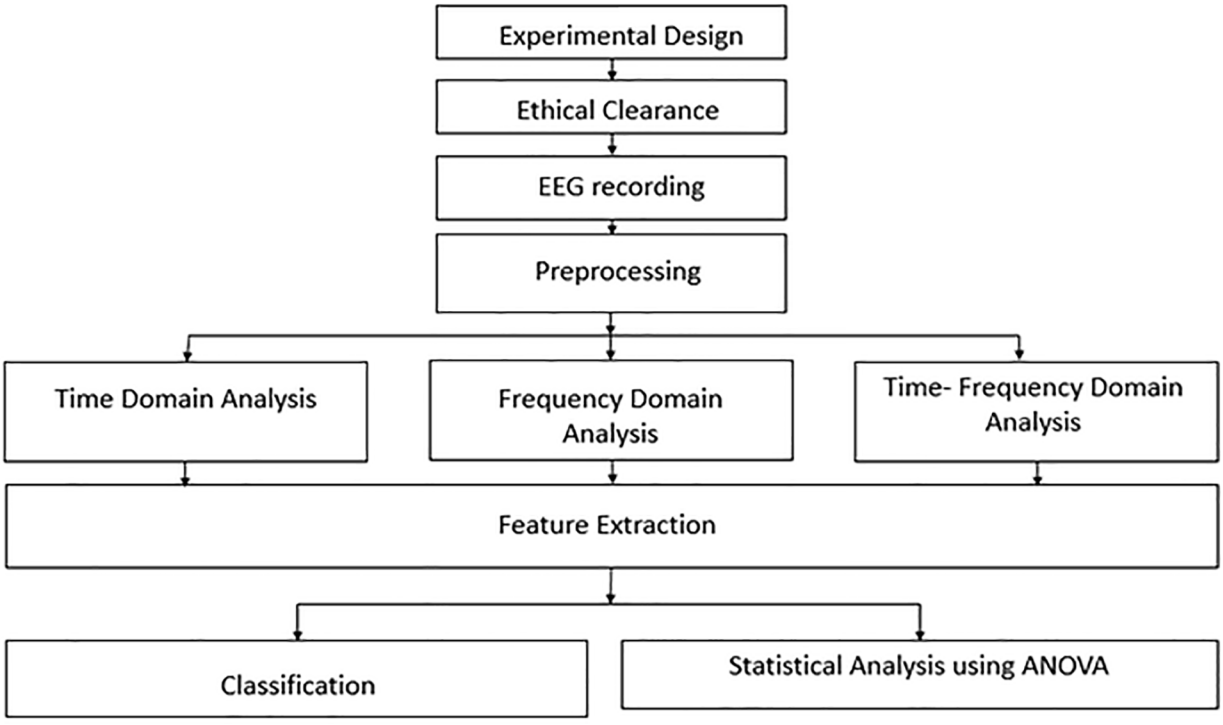

Figure 1. Framework for EEG analysis

be further extended in time domain. In order to reach more sound results it is suggested that a control group design is needed. Still very few studies have been conducted for Om meditation considering its effectiveness level. In this paper, we have also added a proposed method to explore the area of EEG analysis of Om meditation.

Since the studies conducted on EEG analysis of Om meditation are less in number and more research can be carried out in this direction, a step wise description is provided below which can help researchers exploring further this area of study. Figure 1 shows the EEG framework of EEG analysis. The first phase is to choose a proper experimental design. It is the process of outlining a study to meet defined objectives. Phase one is a very important step since it makes certain that the correct data of sufficient sample size and power is available to carry out the research in a valid and replicable way (Malik & Amin, 2017). The ethical issues should be handled before the data collection. In EEG recording phase, raw EEG signals are collected from the scalp of the brain (Puce & Hämäläinen, 2017). The next phase is preprocessing which includes artifact removal and data filtering (Ames, 1971; Basar, 1999). EEG signal is now free for time, frequency, and both time and frequency domain analysis (Al-Fahoum & Al-Fraihat, 2014). The next phase after analysis is the feature extraction. It is used to find features or information that can lead us to classification (Güler & Übeyli, 2005; Kordylewski, Graupe, & Liu, 2001; Übeyli, 2008). And the last stage is signal classification. Signal classification process can be carried out by various methods such as linear analysis, nonlinear analysis, adaptive algorithms, clustering and fuzzy techniques, and neural networks. The feature vector data obtained is analyzed and its algorithmic characteristics lead to a hypothesis (Kordylewski et al., 2001; Subasi & Ercelebi, 2005). Statistical analysis using Analysis of variance (ANOVA) or two way repeated ANOVA are used to test the hypothesis of the study.

Om Meditation Studies Using Middle Latency Response (MLR)

Table 3 summarizes the studies conducted on MLR to examine the effect of Om meditation.

Table 3

Om Meditation Studies Using Evoked Potential (EP) and Middle Latency Potentials Response (MLR)

Om chanting type	Subjects	Type of meditators	Method / Signal Processing	Experimental Design	Findings
Telles, Nagarathna, Nagendra & Desiraju (1994)					
Mental Om meditation	18	Both naïve and experienced	AEP- MLR	Two sessions Relax (6 min) → Mental Om meditation → Relax (6 min) → Mental repeating word 'One'	Study revealed differences among senior and naive meditators, naive meditators require extra effort to practice meditation.
Telles, Nagarathna, & Nagendra (1995)					
Mental Om meditation	14	Both naïve and experience	MLR	Relax (6 min) → Mental Om meditation → Relax (6 min) → Non targeted thinking	Reduce HR indicate psychophysiological relaxation.
Telles, Nagarathna, & Nagendra (1998)					
Mental Om meditation	12	Both naïve and experienced	MLR	Three sessions Mental Om meditation (MOM) (15 min) → Mental repeating word (COM) (15 min) → Neutral thinking (15 min)	Skin resistance level reduces during mental Om meditation; Heart rate (HR) reduce; Respiratory rate (BR) reduce

Note. AEP = Auditory Evoked Potentials; MLR = middle latency response method.

Among the subjects categorized as meditators and naïve, the studies were carried out in three sessions of mentally chanting Om, mentally chanting One and neutral thinking (Telles et al., 1995; Telles et al., 1998). The experimental results showed increased peak amplitude of the Na wave during meditation among experienced meditators[1] which was correlated with an increase in the number of neurons recruited (Kumar et al., 2010), whereas a decreased amplitude in Na wave during control session was observed revealing reverse implications (Kumar et al., 2010; Telles et al., 1994). From the three studies conducted by Telles and her co-authors, it can be concluded that Om meditation produces significant health benefits such as reduced respiratory rate, reduced heart rate, reduced skin resistance and leading to a state of relaxation (Telles et al., 1994; Telles et al., 1995; Telles et al., 1998).

Om Meditation Studies Based on Other Methods

In order to find potential further benefits of Om meditation, other methods such as Galvanic skin response (GSR) and audio analysis were also evaluated (Das & Anand, 2012; Gurjar, Ladhake, & Thakare, 2009). Table 4 summarizes the studies conducted using other methods on Om meditation.

Table 4

Om Meditation Studies Using Other Variables

Om chanting type	Subjects	Type of meditators	Method/ Signal Processing	Experimental Design	Findings
Das & Anand (2012)					
Loud Om chanting	20 (All female)	-	Galvanic Skin Response (GSR)	Prayer (15 min) → Om Meditation (15 min)	significant increase in GSR values as an effect of prayer and meditation which suggested the Psycho physiological relaxation
Gurjar, Ladhake, & Thakare (2009)					
Om chanted sound	-	-	Wavelet analysis if speech signal	-	Om chanting affords steadiness in mind, calm and peace to the stressed mind

The study on skin responses by Das & Anand (2012) revealed the Psycho-physiological relaxing effect of Om meditation and prayer. Gurjar et al. (2009) carried out a study on the audio record of Om sound. Wavelet analysis of Om chant using MATLAB revealed the positive effects of chanting Om mantra such as stabilization of brain, removal of earthly thoughts and increase of energy. The study concluded that daily practice of Om mantra helps in increasing level of human attention and concentration (Gurjar et al., 2009). Om chanting can be considered as a contributing factor to support human being affected by high levels of stress and as medicine for human being under stress.

Comparison of Om Sound With Other Sounds

Table 5 demonstrates the comparison of Om sound with other sound like 'ONE' and 'SSS'. Om sound application seems to produce better results. Further studies can be conducted by comparing it with any other relaxing sound.

Table 5

Comparison of Om Sound With Another Sound

Compared sound	Effect of Om sound vs other sound
Telles, Nagarathna, & Nagendra (1998)	
Om is compared with mental repetition of "ONE"	Om sound alone was responsible for reducing skin resistance indicating a change in mental state.
Telles, Nagarathna, Nagendra, & Desiraju (1994)	
Om sound is compared with mental repetition of "ONE"	Effect of Om sound observed in expert meditators.
Kalyani et al. (2011)	
Om sound is compared with "ssss" sound	The "ssss" task did not produce any significant activation/deactivation in brain regions as produced by Om sound.

Conclusion and Future Directions

The effects of Om meditation on the brain and other parts of the body have been explored with various methods. The findings are varied in nature which warrants a need for empirical, experimental and theoretical studies in this field. Recent efforts on Om mantra meditation have used neuroimaging and evoked potentials study. Moreover, most of the studies are based on mental Om chanting. This paper suggests the need for further research in the field of Om meditation using EEG as a tool for analyzing mental effects of Om meditation.

Various signal processing techniques, namely fast Fourier transforms, wavelet transforms, independent component analysis, principle component analysis, coherence analysis (Kaur & Singh, 2015) can be added to investigate the information in EEG during loud Om mantra meditation.

Questioning the medicinal properties and relaxing effect of Om meditation practice is a strong impetus for future studies. Further studies are needed to examine the effects of cultural dependency and gender dependency on Om meditation. The study on this mantra carried out on subjects with different medical conditions, different age groups, different working conditions and different physical posture may help to evaluate the effect of Om meditation even better. Such studies may prove useful for society as a whole. This review argues for the EEG analysis of the loud Om mantra.

Limitations of This Review

Despite of the beneficial and stress relieving effects of Om meditation, some people are reluctant to practice it because of its religious background. We have tried to cover all studies conducted on Om meditation and summarize the effect of Om meditation on the human body. Due to a small sample size and little research in this field, only some effects of Om meditation are presented. The paper suggests a need for further research in this field, through sounder and better methodological approaches with the aims for establishing the potential positive effects of Om meditation both for physical and mental well-being.

Notes

1) Experienced meditators are the one who perform Om meditation daily whereas Naive meditators are the one who do not follow the practice of meditation daily. No scale has been given in the papers (Telles et al., 1995; Telles et al., 1998) which we have refered to compare Naive and experienced meditators.

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Competing Interests

The authors have declared that no competing interests exist.

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