EFFECT OF MEDITATION ON BALANCE ABILITY

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ABSTRACT

The purpose of the study was to investigate the effect of meditation on balance ability. Meditation is a practice in which an individual trains the mind or induces a mode of consciousness, either to realize some benefit or as an end in itself. Despite its popularity, little is known about the neural mechanisms by which meditation works, several electroencephalogram (EEG) studies have reported changes in spectral and frequency analysis during meditation inspired by techniques that focus on concentration. The aim of this study was to examine EEG changes associated with meditation practice and whether these changes in EEG pattern were associated with the occipital region. Frequency analysis was used to analyze investigate the composition of an EEG signal. Forty students studying were randomly selected as the subjects for the study. The age of the subjects ranged from 21 to 30 years. The subjects were assigned at random to experimental and control group; each group consisting of twenty students. The study was conducted for a period of eight weeks. The present study examined EEG changes during meditation. The investigational paradigm involved 15-20 minutes of meditation, where the subjects were asked to close their eyes and adopt their normal meditation. Two groups comprising of twenty-five subjects each were formed i.e. experimental Group and control group. The experimental group was given meditation in the morning session time and no meditational training was given to control group. Each subject of Experimental group was learning concentrative Meditation. The data on Electroencephalogram (EEG) and balance ability was collected the data before and after meditational training to measure the effect of meditation. Data were analyzed by using analysis of covariance at 0.05 level of significance. On the basis of EEG analyses it reported increase alpha activity in practice meditational group as compared to control group. The findings produced increased occipital alpha power in experimental group than the control group, it also observed in increased theta power across multiple cortical regions. Further Analysis of co-variance results revealed the insignificant difference found in balance ability (2.650) and in waves the Delta, Theta and Alpha waves and insignificant difference (.527) found in Beta waves. These results suggest that meditation provides no improvement in balance ability. EEG findings from this study suggest that concentrative meditation techniques improves theta and alpha EEG patterns significantly.

Keywords: Electroencephalograph (EEG), Meditation fast Fourier transforme (FFT) and Balance ability

INTRODUCTION:

When a person is not doing anything at all bodily, mentally i.e. when all activities have ceased and one simply is, just being fully aware of his existence, that’s what meditation is. In other words, meditation is just to be, not doing anything –no action, no thought, no emotion. One just is and sheer delights. This delight comes from nowhere or from everywhere and without any causative factors, because existence is made of the stuff called joy. (Rai & Murthy ,1998)
The word meditation originally came from the Indo-European root med-, meaning "to measure." From the root med- are also derived the English words mete, medicine, modest, and moderate. It entered English as meditation through the Latin meditation, which originally indicated every type of physical or intellectual exercise, then later evolved into the more specific meaning "contemplation."

Now scientific knowledge may, however, be added. But the yogic concept of the merging of the individual consciousness with universal (cosmic) consciousness as envisaged in the “Nirvikalpa” thoughtless states of stasis and other higher states of consciousness, may be (and are the present at least) beyond the domain of neurophysiology. at the same time it is noted that meditation is more of the nature of an a experience than a experiment. This experience is worth a trail even without knowing the ‘what and how’ of it. Many mysteries of brain have been unraveled by neurophysiology, but there is one part on the brain which has still remained an enigma. It is the pre-frontal area of the frontal lobes of the cerebral cortex. This is the foremost part of the brain situated behind the forehead. The record of electrical activity (potential) measured from the brain or scalp(outer surface of the head),known as brain waves, energy pulsation or undulations is called an a electroencephalogram(EEG).these brain waves are measurable with brain-electroencephalograph equipment .

There are a number of benefits to using EEG in neuroscience research. One is that EEG is non-invasive to the research subject. Furthermore, the need for the subject to hold still is perhaps less stringent than in functional magnetic resonance imaging (fMRI). Another benefit is that many applications of EEG record spontaneous brain activity, and the subject does not need to be able to cooperate with the research (e.g., as is necessary in the behavioral testing of neuropsychology). Also, EEG has a high temporal resolution compared to techniques such as fMRI and is capable of detecting changes in electrical activity in the brain on a millisecond time scale.
METHOD:
The effect of meditation was measured by using Electroencephalogram (EEG).

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Test</th>
<th>Measurement/Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meditation</td>
<td>Electroencephalogram(EEG)</td>
<td>Fast Fourier Transformation (FFT) and Frequency Analysis</td>
</tr>
</tbody>
</table>

Balance ability

The aim of this test was to walk the entire length of a standard balance beam steadily, without falling off and within a six second time span. The participant started at one end, stepped up onto the beam, and walked the length to the other end. The test was repeated three times.

Points systems are as follows:
1. Five points- Walks the balance beam flawlessly. Does not need to check balance, no pause. Completes the walk within six seconds.
2. Four points- Walks the beam, but is somewhat unsteady. Completes the walk within six seconds.
3. Three points- Walks the beam, but is somewhat unsteady. May pause one or more times. Takes more than six seconds to complete the walk.
4. Two points- Walks the beam, but is very unsteady, almost falling off, may pause one or more times, and/or takes more than six seconds.
5. One point- Falls off the beam before completing the walk.
6. Zero point- Falls off the beam immediately.

Scoring: Participants were given three trials to complete the beam walk. The table below lists scores based on subjective observations of the beam walker. For more accuracy, team of three judges were to ask observe a given individual perform. The score for each trial was
the average of all the judge’s scores. The overall score for the individual was the average of the three trial scores.

Reliability: Three judges were used to improve reliability of assessors (Inter-rater reliability), and three trials per individual were allowed to improve reliability over time (Test-retest reliability).

THE EXPERIMENTAL DESIGN:
The pre-test post-test randomized group design was used for the present study. Two Groups were made and each group comprised of twenty subjects. These subjects participated voluntarily in the study.

The study was conducted for a period of eight weeks. The subjects were assembled in the Hall for six days per weeks. Two groups comprising of twenty-five subjects each were randomly formed i.e. experimental group and control group. The experimental group was meditating in the morning session and no meditational training was given to control group. Teacher briefly introduced to experimental group the technique of concentrative meditation. The subjects of experimental group practiced concentrative meditation for 15-20 minutes every day in meditative position with closed eyes.

Electroencephalogram (EEG) and balance ability used to collect the data before and after meditational training to measure the effect of meditation.

Electroencephalograph: To record electrical signals of the brain. This electrical activity was detected by electrodes, placed on the subject's scalp and transmitted to a polygraph that recorded the activity.

The EEG data was analyzed using frequency analysis to determine the power spectrum. Further Analysis of Co-Variance was employed to determine whether the experimental treatment was effective in bringing about a significance changes in brain waves of the experimental group in contrast to control group.
RESULT:

Table 1

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balance Ability Post</td>
<td>1.324</td>
<td>1</td>
<td>1.324</td>
<td>2.451</td>
<td>.111</td>
</tr>
<tr>
<td>Error</td>
<td>19.983</td>
<td>37</td>
<td>.540</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Significant at 0.05 level

$F_{0.05} (1, 37) = 4.10$

Table 1 reveals that there was a insignificant difference in balance ability between experimental and control groups as calculated value (2.650) lower than the tabulated value (4.10) at 0.05 level of significance.

Chatterjee (2009), observed in case of balance ability performance all the three durations of Yoga Nidra was found significant effect on Balance ability. Beyond It depended upon coordinative abilities, and complex combination of cognition and psychic factors. Another study conducted by R.K Hakim that the Tai Chi and yoga exercise groups demonstrated better balance performance than the control group. Tai Chi and yoga are both economical and effective methods of low impact exercise that can be incorporated into a fall-prevention program for older adults in many settings. Another study by Shivesh studied the Meditation and Proprioceptive training on Cognitive Neuromotor development for Badminton is significant difference is seen in balance test right leg with closed eyes.

The study shows insignificant effect related to concentrative meditation did not support Players-A combined effect. After comparing the neuromotor ability of mean and standard deviation there the above studies on balance ability which may be due to the lack of physical, kinetic abilities and higher anxiety.
Table 2
Effect of Meditation on Experimental and Control Group on Different Brain Waves

<table>
<thead>
<tr>
<th>Brain Waves</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delta Waves</td>
<td>3131.457</td>
<td>1</td>
<td>3131.457</td>
<td>24.195</td>
<td>.000</td>
</tr>
<tr>
<td>Between</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>4788.794</td>
<td>37</td>
<td>129.427</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Theta Waves</td>
<td>1747.137</td>
<td>1</td>
<td>1747.137</td>
<td>15.309</td>
<td>.000</td>
</tr>
<tr>
<td>Between</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>4222.493</td>
<td>37</td>
<td>114.121</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alpha Waves</td>
<td>9541.887</td>
<td>1</td>
<td>9541.887</td>
<td>59.868</td>
<td>.000</td>
</tr>
<tr>
<td>Between</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>5897.158</td>
<td>37</td>
<td>159.383</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beta Waves</td>
<td>26.889</td>
<td>1</td>
<td>26.889</td>
<td>.408</td>
<td>.527</td>
</tr>
<tr>
<td>Between</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>2439.989</td>
<td>37</td>
<td>65.946</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Significant at 0.05 level F.05 (1, 37) = 4.10

Table 2 indicate that there was a significant difference found among experimental and control group on Alpha, delta and theta waves as calculated value was greater than that of tabulated value and insignificant difference found in case of beta wave as it was found lower tabulated value at .05 level of significance with 1,37 df.
Frequency Analysis Depicting Different Brain Waves of Pre Test of Experimental Group

Graph 1

Frequency Analysis Depicting Different Brain Waves of Post Test of Experimental Group

Graph 2
The frequency analysis (Graph 1) indicated increased delta and theta power in pre testing and alpha power was found on lower side which was indicator of subjects being in sleep or drowsiness. In post test the alpha power showed significant increase (Graph 2) in comparison to other brain waves. Synchronization of alpha power is indicator of better concentration which alluded to the fact that meditation had positive effect and was instrumental in enhancing concentration.

Frequency Analysis depicting Different Brain Waves of Pre Test of Control Group

Graph 3

Frequency Analysis Depicting Different Brain Waves of Post Test of Control Group

Graph 4
The analysis revealed little higher delta and theta power in pre testing as evident from the graph showing brainwaves trends in control group but alpha power was found on lower side which probably indicated that the subjects were in the state of sleep or drowsiness and same pattern was observed in post testing.

**Mean Comparison of Experimental Group in Pre and Post Test**

**Mean Comparison of Control Group in Pre and Post Test**

**FINDINGS:**
On the findings it produced increased occipital alpha power in experimental group than the control group it also observed in increased delta, theta and alpha power across multiple cortical regions after the meditation. In few studies have reported the findings concerning frequencies during meditation.
In one of the study conducted Jim Lagopoulos and others were found significantly increased theta and alpha power was found for the meditation condition when averaged across all brain regions, and it was found that alpha was significantly greater in the posterior region as compared to the frontal region. There was also a significant increase in delta power in the temporal–central region in the meditation condition compared to rest. On the basis of above study reported that meditation alters theta and alpha EEG patterns significantly than control group. The result shows that the performance of the meditation produce changes in spectral analysis of the EEG.

In the light of conclusions drawn the following recommendation were made:

1. The similar study may be conducted on different psychomotor variables by using EEG.
2. The same study may be conducted on various age groups.
3. The similar study may be conducted by using various meditational techniques such as Zen meditation, transcendental meditation, mindful meditation etc.
4. Correlation analysis may be done with other Bio signals.
5. Different method of signal analysis may be used for information.
6. Different brain waves may be used for further studies

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