

EFFECT OF HINDUSTANI VOCAL MUSIC ON HUMAN BRAIN WAVES IN HEALTHY VOLUNTEERS

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Abstract: Introduction: It is an experiential fact that most of us find peace by listening to music. There have been researches to establish relation between music and brain especially in western classical music. Further, there have been studies in Indian classical music where instruments like flute or violin have been used. However, Hindustani vocal music is an unexplored area and more research is required in this field. This study is an attempt to know the kind of brain waves which are predominant during listening to Hindustani vocal music.

Aim: To measure the brain waves Delta, Theta, Alpha, Beta.

Methods and materials: The study was conducted as an observation with a sample size of 20. The design of the study was single group PRE-POST. The intervention given was 'Raag Deshkar' and brain waves were captured using a BCI(Brain Computer Interface)- Neurosky Mindwave Headset and then analysed using R Studio.

Results: The data was normally distributed hence paired sample t-test was conducted on all the variables. Theta wave showed statistical significance between PRE vs POST ($p < 0.05$). Other variables were found to be statistically non-significant ($p > 0.05$).

Conclusion: It can be concluded that as the theta wave is predominant, this raga induces inner peace, emotional stability, Deep relaxation, speedy healing, more restful sleep, reduction of mental fatigue, reduction of anxiety and stress.

Keywords: Hindustani vocal music, EEG, Mindwave, Raag deshkar

INTRODUCTION

“śiśurvetti paśurvetti vetti gāna rasam phaṇi:”

“The nectar of music is enjoyed by a child, by all the animals and even by the snakes”. Sangeetam as we hear in India be it Hindustani or Carnatik, is the combination of singing, instrumentals and dance. (1)

gīta vādya nrityānām trayam saṃgītamucyate 1.3(Narada, 1210)

It is a common experience for us that the interjectional sound for expressing different emotions is common to both man and higher animals. Whatever the origin of music, it is universally agreed that music is natural to man. Ever since the dawn of civilization, man has been giving expression to his feelings in music in some or the other form.

The sound the ear hears is of two types

- Non-musical sound which in scientific jargon is called as **noise**
- Musical sound called **tone**

While the colour is just colour and nothing more to the eyes, the eye has only one kind of sensation using which it identifies one order. However, sound is not just sound, the sensation of sound is of a different order. It is entirely different from the non musical sound. This explains upto certain extent why people are unable to appreciate good music as their ear is not accustomed to listen to the musical sound, they only listen to the noise of daily routine.

A body must vibrate if it is to be heard. This vibration is in the form of waves. The number of vibrations per second or unit time is called as frequency. Of the many sounds we hear, some strike us as naturally sweet eg., the sound of piano or a veena and some do not appear as sweet for instance the barking of dog, screeching of a parrot. The former kind of sound is musical and the latter is non-musical. Technically they are called tone and noise respectively. In case of tone, the vibrations are comparatively simple and they fall on the ear with uniform frequency. In case of noise, the vibrations are complex and have irregular frequency.(2)

Science defines this musical sound or tone from a point of its physical structure. Indian music calls a tone as a svara. Sage Narada in Sangeeta Makaranda states:(3)

śrutyantarahāvī ya: snigdho anuraṇātmaka:.

svato raṁjayati śrotrucittam sa svara ucyate|| (Sa.Ma 3.1)

When we stike a string set to a certain pitch, a sound is produced and it does not stop there, a continuous sound is generated due to that strike, creating a resonance (anuraëä). The first sound produced and heard is called shruti. The resonance which is melodious and with a continued pitch is called as a svara or tone.(3)

āyurdharmayaśobuddhi dhanadhānyaphalam labhet.

rāgābhivruddhiḥ santānam pūrṇarāgau pragīyate..n.ma(3.80)

vyādhināśi śatrunāśi bhayaśokavināśane.

vyādhidāridrya santāpe viśamagrahamocane.. n.ma (3.82)

By singing raagas with 7 swaras, longevity of life, willingness to do austerities, fame in the world, the power of discriminating good and bad, money, food and children can be obtained. Further, by singing ragas with 5 notes a person gets rid of diseases, enemy, fear, grief, sorrow, poverty and ill placement of planetary positions in a horoscope. (Narada, 1200)

Further, listening to music regularly helps keep the synapses and neurons more active. Music is a valuable instrument to evaluate our brain system. Different parts of brain is involved in processing music which include auditory cortex, frontal cortex, cerebral cortex and even the motor cortex.

Electroencephalogram(EEG) is a a neuro-scientific biosensor using which we can understand the complex activities of the human brain upto some extent. EEG can be measured by means of electrodes placed on the scalp or directly on the cortex. Traditionally, human EEG spectrum can be divided into five frequency bands:

- Delta(0-4Hz)
- Theta(4-8Hz)
- Alpha(8-13Hz)

- Beta(13-30Hz)
- Gamma(>30Hz)

The delta waves are seen usually during deepest relaxation and deepest healing. The theta waves are seen when there is inner peace and emotional stability, these waves release mental fatigue too. The alpha waves are produced when the brain is active, it is responsible in memory retention and a state of increased concentration. Beta waves are seen during tension and expectancy states, these waves are produced when there are unfocussed thoughts, anxiety and stress. (4). Human brain is divided into two cerebral hemispheres, right and left. These hemispheres consists of 4 lobes:

- Frontal lobe: has motor area
- Parietal lobe: contains sensory area
- Temporal lobe: contains area of hearing and memory
- Occipital lobe: contains area of vision

A traditional EEG has electrodes placed in such a way that all the above areas are covered(10-20 international system and 10-10 international system). At the end a graph is obtained of all the waves filtering the gamma wave and using the available wave forms the graph is analysed.

The buddhi or the intellect which we experience in our day to day life is the greatest gift to humankind. All other animals experience feelings like hunger, sleep, fear, procreative urge including humans but what makes humans different from other animals is their intellect, which he uses to discriminate what is right and what is wrong. (5)

āhāra nidrā bhaya maithunaṃca sāmānyametata paśubirnarāṇām.

buddhirhi teśām adhiko janeśu buddhirvihīnaḥ paśubhiḥ samānaḥ..

Hence, human brain is definitely an area of research especially with music to know more functioning of the brain. This study deals with the effect of music on the human brain using the EEG.

METHODS

PARTICIPANTS

A total of 20 subjects participated in the study irrespective of gender aged between 18-35. Most of them are students of a yoga university and were of normal health based on routine case history. All the participants wilfully participated in the study, the procedure was explained to all of them and signed consents were obtained.

DESIGN OF STUDY

It is a simple pre-post design. Subjects were made to sit comfortably and instructions were given to him/her in English. Later the subject was asked to wear “Neurosky Mindwave headset”. The device was switched on and then connected to the mobile android application. In the first 5 minutes of the

data collection the subject had to close the eyes and sit comfortably with the instrument on and collecting the data, this is named as PRE. From the 6th minute the intervention started until it ended at 13.33 minute(8.33 minutes) and is named as DURING and then from 13.34 minute again for five minutes the data was collected as the subjects still closed their eyes and sat comfortably and is named as POST. This makes it a total of 18.34 minutes. The time points which are taken into considerations are PRE vs DURING and PRE vs POST for Delta, Theta, Alpha and Beta.

ASSESSMENT TOOLS

The EEG has opened new frontiers in the brain related researches. Further Neurosky mindwave being a Non invasive tool require no special training to handle it. This tool accurately measures EEG waves (alpha, beta etc) and also parameters like attention and meditation. The device has a headset and enables recording the brain signals for further analysis for any given task. Current invasive methods do not deal sufficiently with the need for long-term stability in performance therefore non invasive method is always preferred. (6)

RESULT AND DISCUSSION

Normality test was done using Shapiro wilk's test and the data was found to be normally distributed. As the data were normally distributed, parametric tests was conducted (paired sample t-test) on all the variables. The data were found statistically significant for the theta wave for PRE vs DURING and PRE vs POST ($p < 0.05$). Other variables were found to be statistically not significant ($p > 0.05$). The following are the analysis:

DELTA LEVEL:

PRE vs DURING: The delta wave in DURING is lesser than in PRE.

PRE vs POST: The delta wave in POST is more compared to PRE.

After listening to this raga the person can achieve a state of deepest relaxation and a deep sleep state.

THETA LEVEL:

PRE vs DURING: Compared to PRE Theta wave has increased in DURING

PRE vs POST: This wave is more in POST than in PRE

As there is a gradual increase in Theta wave from PRE to POST, we can say that this raga can induce deeper relaxation and help in healing and can also take the subject into a state of mental peace and remove fatigue.

ALPHA LEVEL:

PRE vs DURING: PRE has high alpha wave when compared to DURING.

PRE vs POST: PRE has high alpha wave when compared to POST.

The participants were alert and conscious in the PRE state but DURING and POST the intervention the alpha waves decreased.

BETA LEVEL:

PRE vs DURING: PRE has low beta wave when compared to DURING

PRE vs POST: PRE has low beta wave when compared to POST

This may be an indication that they were cognitively involved in the process of listening to the music, in the DURING phase of the intervention. Further enhancement of beta in POST phase may indicate alertness (about the content of the music). When we observe this wave with alpha subjects were ‘alert and relaxed’ at the same time.

CONCLUSION

Raag Deshkar has a rasa of shringara, which signifies beauty and the aesthetic sense associated with it. Shringara represents the way of presenting oneself that brings joy and peace to the surrounding environment.

The delta wave analysis indicates that listening to this raga allows individuals to achieve the deepest relaxation and a state of deep sleep. The theta wave analysis suggests that this raga can induce deeper relaxation, aid in healing, promote mental peace, and alleviate fatigue.

The alpha wave analysis shows that participants were alert and conscious before the intervention, but became more relaxed during and after the intervention, as evidenced by a decrease in alpha waves. The beta wave analysis indicates that participants were cognitively engaged with the music during the intervention. The increase in beta waves after the intervention suggests heightened alertness regarding the music content.

Overall, assessing all brainwaves indicates that this raga induces both alertness and relaxation simultaneously. This dual state is also the aim of yoga practice, where one achieves relaxation while remaining alert. It can be concluded that the goal of ancient techniques, whether yoga or music, is to achieve this balanced state of mind.

Further studies in this area are necessary. Exploring the therapeutic potential of various ragas could greatly benefit society.

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