

IMMEDIATE EFFECT OF MUSIC ON MEMORY IN MEDICAL STUDENTS

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ABSTRACT

Background: Learning is important process in our life. The learned information and experiences are retained in the form of memory. The students learn many newer things continuously. Most of the students suffer from problems related to memory retention due to stress, workload, anxiety and tension. Many students listen music while studying to reduce stress. Hindustani classical music includes various Raag. The beauty of these raag is that for different time of day and night, different raag is sung. Raag Lalit, Bhairav, Todi, Bhairavi, Bilawal, Deshkar and Aasavari are morning raag. In this study we want to know immediate effect of listening raag Bhairavi, on memory. The aim is to know immediate effect of listening raag Bhairavi on memory. The objective is to study immediate effect of raag Bhairavi on verbal and spatial memory of male and female medical students of same age group.

Materials and Methods: Study included 30 voluntary participants. Pre-test verbal and spatial memory assessment was done. Post-test verbal and spatial memory assessment was done immediately after listening Raag Bhairavi flute version for 20 minutes. Statistical analysis was done using paired T test.

Result: The spatial memory scores improved significantly following the intervention demonstrating a highly significant enhancement in spatial memory. No significant change in verbal memory scores after the intervention.

Conclusion: There is positive significant increase in spatial memory score after listening raag Bhairavi for 20 minutes. Study on long term effect of listening raag Bhairavi is required. Raag Bhairavi can be tried to improve long term memory.

INTRODUCTION

Learning is important and continuous process in our life. It helps to develop thinking and problem solving. Learning increases confidence and helps overall growth of an individual. Learning means acquirement of new information or knowledge by experience. The learned information and experiences are retained in the form of memory. This stored information can be utilized at any time as required. The information can be stored for years together in the form of long term memory.^[1] Students learn many newer things continuously. This acquired knowledge must be retained for longer duration. Most of the students suffer from problems related to memory retention due to stress, workload, anxiety and tension. This problem is aggravated during examination due to examination fear. If stress, tension and anxiety are reduced students can perform better. Many students listen music while studying to reduce stress. MRI studies

have shown that amygdala, hippocampus, orbitofrontal cortex, parahippocampal gyrus, nucleus accumbens and temporal poles are active during music listening.^[2-4] It has been observed that listening to music leads to neuromodulation in areas involved in memory circuits.^[5] Some of the studies have suggested that upregulation of neurotransmitters like dopamine, glutamate and release of neurotrophins play a key role in the mechanism of neuromodulation.^[6,7] The Hindustani classical music includes various Raags. The beauty of these ragas is that for different time of day and night, different raga is sung. Raag Lalit, Bhairav, Todi, Bhairavi, Bilawal, Deshkar and Aasavari are morning ragas. In this study we want to know immediate effect of listening raag Bhairavi, on memory.

Review of Literature

There are studies conducted to know effect of music on short term and long-term memory. These studies include effect of Hindustani classical music,

Carnataki classical music and western music. Effects of music on EEG waves are also studied. Studies are also done to know effect of background music on memory. Effect of listening to Raag Darbari for 15 min for 30 days in young adults was observed at neurophysiology department, NIMHANS, Bengaluru. They observed a significant improvement of word recall after 15 minutes, for word recall and story recall. The sleep quality was also improved in participants. 2A Study was conducted on healthy college students at Swami Vivekanand Yoga Anusansadha Samsthana University, Bangalore. They studied immediate effect of listening to Indian raag Bhupali for ten minutes on attention and concentration. It was compared with effect of listening to pop music and effect of no music. They found significant improvement in memory scores after listening raag Bhupali as compared to pop music and no music group.^[8] IIT, Kanpur (2020) study confirmed that listening to ragas activates the prefrontal cortex. As per research published by IIT Mandi (2025) in *Frontiers in Human Neuroscience* it is revealed that listening to Indian Classical Ragas can significantly influence brain activity, enhancing attention, emotional regulation, and mental stability.⁹ An experiment was performed at Srinivas Institute of Medical Sciences & Research Centre, Mangalore to study effect of Indian classical music on brain activity using EEG signals. Three different EEG were recorded. EEG before listening to Carnatic classical music, EEG with music and EEG after music. The study showed that while listening to carnatic music the alpha power is high compared to before listening and after listening. Higher magnitude of alpha wave while listening to music indicates that person is comfortable and relaxed and music produces calmer effect and synchronizes the sensory inputs.^[10] Asian nursing research reported that music therapy may have experienced more joyful emotions and also improve cognitive function and positive behaviour in group music therapy.^[10,11] While listening to music the power of alpha wave from temporal lobe is significantly higher. This shows the person is comfortable and relaxed while listening to music.^[12] It has been observed that brain processes sound at many levels. The music reduces dominant beta waves to alpha wave. This effect is for short duration.^[13] In some studies it is observed that under physiological conditions the music therapy improves reading and literacy skill, concentration and mathematical abilities.^[14-16] A study was done by listening to classical relaxing music after exposure to a stressor. There was reductions in anxiety, anger, and sympathetic nervous system arousal, and increased relaxation after listening to classical relaxing music compared to no- music condition or listening to heavy metal music.^[17] This indicates definite role of Indian classical music in stress relaxation. Shriya M et al observed that background music did not help students to focus or remember things better if music

is heard while studying.¹⁸ Rachit Mathur & Dr. Rithi Baruah found that musical intervention had a positive effect on the performance of the participants in the areas of creativity and memory.^[18,19] Hallam, Price & Katsarou found that calming background music, had a positive effect on students' concentration, there was better performance in arithmetic tasks.^[18,20] Furnham & Strbac found that loud and complex music negatively impacted students' concentration and it leads to distraction during study tasks. They also found that soft and simple music had a neutral to positive effect on concentration. This shows that the complexity and volume of background music play a crucial role in determining its impact on cognitive performance. It also underlies the importance of selecting the right type of music for enhancing focus during academic activities.^[18,21] Chou P.T & Lin C.C observed instrumental background music, enhanced learning efficiency, improved memory retention and reduced anxiety levels during study sessions.^[18,22] Patston & Tippett found that younger students, performed better on memory tasks when listening to classical and instrumental music compared to studying in silence. This shows age-related differences of music on cognition. This suggests music may have varying impacts based on age.^[18,23] Schellenberg, E. G demonstrated that children exposed to music lessons demonstrated improved IQ scores and performed better on memory tests. This underlies importance of age at which person is exposed to music.^[24] Immediate effect of different types of background music viz instrumental music, country music, rock music was observed by Prabhu PS et al. They observed better memory recall in a group not exposed to any background music. Memory recall was decreased in groups exposed to background music viz instrumental music, country music and rock music.^[25] Some studies related to classical music showed music aids in storage and information in memory.^[26-28] This effect may be due decreased stress which made it easy to study and remember the information. They say that music provides sequential information and order of encoding and recalling. Therefore it decreases like hood of skipping or misplacing some portion of text.^[29]

Aim: To study immediate effect of listening music on memory in medical students

Objectives:

- a) To study immediate effect of listening music on verbal memory of medical students of same age group
- b) To study immediate effect of listening music on spatial memory of medical students of same age group

MATERIALS AND METHODS

Inclusion Criteria

- Healthy young adult male and female first MBBS students between age 18 years to 24 years
- Normal hearing
- Individuals liking to listen music

Exclusion Criteria

- History of deafness, ear infection or any other ear problems
- History any medication for acute or chronic condition
- Students practicing Yoga and meditation regularly as it affects brain functions
- Students learning or practicing music viz classical, western or any other music
- History of smoking, alcoholism

Procedure: Institutional ethical clearance was obtained. IEC No 2026001, dated 05.03.26 Informed written consent obtained from all the voluntary participants. Total 30 students participated 14 males and 16 females. Study was conducted on 18.5.2025 at department of Physiology, M.R. Medical college, Kalaburagi, Karnataka, between 8am to 9am. Study was conducted in sound proof room. All voluntary participants were asked to relax comfortably for 5 minutes. After relaxation pre-test verbal memory and spatial memory assessment was done.

Pre-test memory Assessment

a) Verbal memory assessment done by immediate word recall. 20 commonly used five letter words viz shape, image were displayed on screen at a constant rate of one word for two seconds. Then participants

were asked to recall the words and write them within 60 seconds on a paper provided for verbal memory score. The participants were asked to write the words as they recall, not in the same order as we have displayed. Score 'one' for correct answer and score 'zero' for wrong answer was given and total score calculated.

b) Spatial memory assessment done by using 20 familiar objects like pen, pencil, watch. These objects were arranged on a table and 15 seconds time was given to observe these objects. Then participants were asked to recall the names of objects seen and write within 60 seconds on a paper provided for spatial memory score. Scoring was done same as that of verbal memory.

Post-test Memory Assessment

After pre-test memory assessment, all participants were asked to sit comfortably, relax and hear flute version of Raag Bhairavi for 20 minutes through external music player at comfortable listening level in a sound proof room. We did not prefer use of head phone by individual participants to avoid subjective errors in listening. Post-test verbal and spatial memory assessment was done. The words and objects displayed were different than those displayed for pre-test memory assessment. Memory scoring done same as that of pre-test assessment. Scoring was done in same manner as that of pre-test memory assessment.

RESULTS

Software used: SPSS30.0

Statistical analysis by paired T test

Mean age of study participants 19.7 years.

Table 1: Table showing gender wise distribution of study subjects

Sex	Frequency	Percentage
Female	16	53.33
Male	14	46.67
Total	30	100.00

Table 2: Table showing paired T Test analysis

		Mean	SD	Paired Mean Statistics					T	sig (2-tailed)	Sig
				Mean	SD	SE	95% Confidence Interval of the difference				
							Lower	Upper			
VERBAL MEMORY	Before	13.47	2.99	0.43	2.861	0.522	-0.635	1.502	0.83	0.414	N
	After	13.03	3.22	3							S
SPATIAL MEMORY	Before	13.17	2.87	-2.8	2.384	0.435	-3.69	-1.91	-6.433	<.001	H
	After	15.97	2.08								S

NS – Not Significant

HS- Highly Significant

Paired t-test analysis showed no significant change in verbal memory scores after the intervention (13.47 ± 2.99 vs. 13.03 ± 3.22 ; $t = 0.83$, $p = 0.414$). However, spatial memory scores improved

significantly following the intervention (13.17 ± 2.87 vs. 15.97 ± 2.08 ; $t = -6.433$, $p < 0.001$), demonstrating a highly significant enhancement in spatial memory.

Table 3: Correlation of gender with pre and post-test of verbal and spatial memory

Variable	Pearson Correlation (r) with Gender	p-value	Interpretation
Pre-test Verbal Memory Score	0.217	0.250	Not Significant
Post-test Verbal Memory Score	-0.117	0.539	Not Significant
Pre-test Spatial Memory Score	-0.040	0.836	Not Significant
Post-test Spatial Memory Score	0.148	0.434	Not Significant

Gender showed no statistically significant correlation with either pre-test or post-test verbal and spatial memory scores ($p > 0.05$).

DISCUSSION

Indian classical music has two types of music carnatic music and Hindustani classical music. Carnatic music includes south Indian ragas, tala & pallavi. The Hindustani music contains elaboration of north & south Indian ragas.^[30] The specific raags are sung at particular time of day and night. Listening to the right raga at the right time smoothenes the natural transitions and attune the body and mind to the circadian cycle.^[31] We have conducted study to see immediate effect of listening instrumental version of raag Bhairavi on flute for 20 minutes on verbal and spatial memory. Raag Bhairavi is known as 'queen of raags. Raag bhairavi is traditionally performed in early morning and often presented at the conclusion of musical events.^[32,33] The flute or bansuri is the ancient musical instruments of India. The lord Krishna played flute. The flute relieves the human mind from depression, tiredness, fatigue. It makes people happy. According some scientists, music is the only medium, which makes the human brain smoother and more efficient. The classical flute playing is used in Indian medicine to treat mental illness and brain diseases. The classical flute listening also relaxes the psychological burden of a person.³⁴ We found that there is significant positive immediate effect of listening Raag Bhairavi on spatial memory. The post test scores for spatial memory are significantly increased. According to John A Logan music acts as medicine of mind. The neuron and synapse get activated by listening to music regularly. Activation of neuron and synapse depends on sound wave heard.^[35] Frontal midline power is increased while listening to music.^[36] Same is the effect of meditation.^[37] Music with a range of 60-80 beats/min has calming effect to brain and it mainly depends on pitch, harmony & melody of music.^[10] Different studies have shown varying effects of music on memory. A study on effect of listening raag Bhairavi in Virtual reality for six days, has showed decreased stress score, anxiety score and depression scores.^[32] The activity in amygdala, orbitofrontal cortex, parahippocampal gyrus, nucleus accumbens and temporal poles is increased during music listening.^[2-4] Release of neurotransmitters like

Dopamine, glutamate and release of neurotrophins is also while listening music.

Calming and smoothening music reduces stress and improves cognition.^[18,21,22] Raag Bhairavi itself decreases anxiety and stress.^[32] Flute sound also relieves tiredness & fatigue.^[34] All these factors and highly melodious nature of Raag Bhairavi might have contributed for increased spatial memory scores after listening to flute version of raag Bhairavi for twenty minutes in our study. For verbal memory we found no significant change after listening raag Bhairavi. This might be because memory needs more repetition and if not done then the memory fades in 30 seconds.^[38] We did not find any gender difference in the memory scores. The immediate effect of listening to Raag Bhupali for 10 minutes showed improvement in memory score.^[8] Listening to Raag Darbari for 15 min for 30 days have shown improved word recall.^[2] We could not find similar studies on immediate effect of Raag Bhairavi on memory. There are more scopes to study effects of this melodious raag on memory.

CONCLUSION

There is positive significant increase in spatial memory score after listening instrumental version raag Bhairavi on flute for 20 minutes. Raag Bhairavi can be tried to improve long term memory.

Limitations: Needs to study long term effects of listening Raag Bhairavi on memory.

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