

**A STUDY ON THE EFFECTS OF MUSIC
LISTENING BASED ON INDIAN TIME
THEORY OF RAGAS ON PATIENTS
WITH PRE-HYPERTENSION**

Suguna V

Masters in Indian Music, PGD in Music Therapy

IJSER

1. ABSTRACT

1.1 INTRODUCTION:

Pre-hypertension is more prevalent than hypertension worldwide. Management of pre-hypertensive state is usually with lifestyle modifications including, listening to relaxing music that can help in preventing the progressive rise in blood pressure and cardio-vascular disorders. This study was taken up to find out the effects of listening to Indian classical music based on time theory of *Ragas* (playing a *Raga* at the right time) on pre-hypertensive patients and how they respond to this concept.

1.2 AIM & OBJECTIVES:

It has been undertaken with an aim to understand the effect of listening to Indian classical instrumental music based on the time theory of *Ragas* on pre-hypertensive patients.

1.3 SUBJECTS & METHODS:

This study is a repeated measure randomized group designed study with a music listening experimental group and a control group receiving no music intervention. The study was conducted at Center for Music Therapy Education and Research at Mahatma Gandhi medical college and research institute, Pondicherry. 30 Pre-hypertensive out patients from the Department of General Medicine participated in the study after giving informed consent form. Systolic BP (SBP), Diastolic BP (DBP), Pulse Rate (PR) and Respiratory Rate (RR) measures were taken on baseline and every week for a month. Pre-hypertensive patients in the music intervention group listened to instrumental Indian classical music in consonance with the time theory of *Ragas* continuously for 30 days. *Ragas* were chosen according to the time the participants listened to music. Control group received no music intervention.

1.4 RESULTS:

The results indicate that DBP and SBP of the music listening group have significant reduction, after 30 days. Results of the control group indicate that there was significant increase in SBP.

1.5 DISCUSSION:

Listening to Indian classical instrumental music resulted in reduction of systolic and diastolic blood pressure significantly. This result is in consonance with the earlier findings with studies involving classical music of different regions across the globe. Researches have indicated that our current mood states influence the way we perceive our emotions in general and this also applies to our felt emotions in respect of our perceived musically–expressed emotions. Also, it is known that our mood states are endogenous in nature following a circadian rhythm⁶. Indian music tradition exposes listeners to music at the appropriate moment, meaning when listeners are especially sensitive to these emotions⁷. Most of the musical interventions were administered during late morning time using Ragas Ahir Bhairav, Bhairavi and Brindavani Sarang expressing Shanta rasa (cluster of emotions being calmness, serenity, relaxation) and Shringara rasa (with the cluster of emotions being love, sensual and affection)⁸. The logical conclusions from these two observations is that musically-expressed emotions can be perceived differently depending on the time of day according to our mood states. However, due to small sample size of 30 subjects, it is difficult to generalize these results on a larger population.

1.6 CONCLUSION:

There are no music interventional studies with pre-hypertensive population using the time theory of *Ragas*, conducted so far and this study gives us a direction to future studies. The results of this study recommend music therapy as a complementary therapy to pre-

hypertensive patients to alleviate their anxiety and stress levels for controlling BP. Further studies are needed to confirm these results.

2. KEYWORDS

Music therapy, Indian music for music therapy, Time theory of ragas, Relaxation music, Music for pre-hypertension, Life style changes through music therapy.

IJSER

3. LIST OF ABBREVIATIONS

1. WHO- World Health Organization
2. BP- Blood Pressure
3. DBP- Diastolic Blood Pressure
4. SBP – Systolic Blood Pressure
5. PR – Pulse Rate
6. RR – Respiratory Rate
7. MGMCRI – Mahatma Gandhi Medical College and Research Institute
8. HOD – Head of the Department
9. CHD – Coronary Heart Disorder
10. EEG - Electroencephalogram test
11. OPD – Out-Patients Division
12. \geq -Greater than or equal to
13. \leq - Lesser than or equal to
14. t test – Statistical Test for between groups difference
15. SD- Standard Deviation
16. F-frequency
17. DF - Degree of freedom
18. P-test - probability of a value

4. LIST OF TABLES

Table No.	Title
1	Demographic Details of the music intervention and control group
2	SBP Measures in the Music Intervention group from 1st week to the 4th week
3	SBP Measures in the control group from 1st week to the 4th week
4	DBP Measures in the Music Intervention group from 1st week to the 4th week
5	DBP Measures in the control group from 1st week to the 4th week
6	PR Measures in the Music Intervention group from 1st week to the 4th week
7	PR Measures in the control group from 1st week to the 4th week

5. LIST OF FIGURES

Figure No.	Title
1	Occupation Bar Chart
2	Gender Bar Chart
3	Age Bar Chart

IJSER

6. INTRODUCTION

National Nutrition Monitoring Board rural survey 2005-2006 on diet and nutritional status of population and prevalence of hypertension among adults in rural areas defines pre-hypertension as SBP from 120 – 139mm Hg and / or SBP 80-90mmHg. As per the survey, about 25% men and 24% women had hypertension (≥ 140 mm of Hg SBP and /or ≥ 90 mm of Hg DBP).¹ Pre-hypertension is more prevalent than hypertension worldwide. In a sample study conducted by Prevalence and Correlates of Prehypertension Among Adults in Urban South India, 55% of the subjects were pre-hypertensive and as against 30% of hypertensive population in South India². As per the Seventh Report Joint National Committee, patients with severe hypertension may represent as much as 25% of all patient visits to busy urban emergency rooms. Pre-hypertension is a common condition and associated with increased vascular mortality. To some extent, it increases risk of nonfatal myocardial infarction, stroke, and congestive heart failure. As per the same report even 5mmHg reduction in SBP is associated with 7% reduction in all-cause mortality, 9% reduction in CHD related mortality & 14% reduction in stroke related mortality.³

When observed for causes, long-term psychological factors like stress, anger and the like are some of the independent predictors of pre-hypertension that will progress to hypertension, coronary artery disease, and coronary artery disease-related death. Pathophysiologically, pre-hypertensive adults share many risk factors with hypertensive patients. Pre-hypertensive adults are also significantly more likely to develop hypertension as compared to normotensive adults; with higher rates of target organ damage and cardiovascular complications. Hence pre-hypertension is considered an intermediate step during progression from ‘Normal BP’ to ‘hypertension’ by many authorities. Management of pre-hypertensive state is usually with lifestyle modifications which includes listening to

relaxing music that can help in preventing the progressive rise in blood pressure and cardiovascular disorders.⁴

From the Vedic period to the medieval period of Tamil *Tevarams* and up to the 19th century of musical Trinities of Carnatic music, evidences show that Indian classic music has been used for healing purposes.⁵ The Indian aesthetic tradition of music and dance is based on a set of nine emotions. An initial list of eight emotions was established in the *Natya Shastra*, a treatise on performing arts dating back to the 3rd century AD. A ninth emotion was added in the 10th century AD, and the list became subsequently known as the *Nava Rasa* (from the Sanskrit *nava*, meaning nine and *rasa*, being sentiment) namely, *shringara* (love, attractiveness), *karuna* (pathos, compassion, sadness), *hasya* (mirth, joy, laughter), *raudra* (anger), *vera* (valour, heroism, majesty), *bhaya* (fear), *bibhatsa* (disgust), *adbhut* (surprise, marvel, amazement) and *shanta* (peace). All the classical Indian art forms are aiming at expressing these *rasas* and evoking them in the audience. According to *Natya Shastra*, although several *rasas* can be present in a given work of art, only one should be dominant.⁷ Inferring from the above, peaceful *rasa* expressed in the music that has healing properties from historic times should evoke the same *bhava* in the listener.

As per Pandit V N. Bhatkande, playing a *Raga* at the right time will increase its emotional impact. He also explains that the *Vadi* or *Jiva Swara* of the *Raga* is also time dependent.¹² In a recent study on the time theory of *Ragas* rendered based on the three *doshas* of Ayurveda on an individual with depression has yielded positive results.¹⁰ In our context, time theory of *Ragas* appears to have been mapped to diurnal cycle. And we are aware that subtle changes occur in our own moods and emotions constantly during different moments of the day. Mental state and emotional responses also vary between seasons like summer, spring and in rainy period. Corresponding to the same are seasonal *Ragas* as per the *Raga Ragini* theory.¹¹

Indian classical music, when rendered as *Alap* is a form of relaxing music. Engagement of the parasympathetic nervous system can facilitate relaxation by positively affecting heart rate, respiration, oxygen consumption, and blood pressure.¹⁹ *Vilampit* or slow or meditative music can induce relaxing effects via interactions with the autonomic nervous system. Listening is one of the methods of music therapy. Melodic and soothing music when used in the listening method of music therapy, promotes a sense of serenity.

There are a handful of studies that have been done investigating the effect of music on various parameters, and most of the studies have shown positive results.²¹ While the effect of music therapy has yielded positive results in different sections of the population e.g. Pregnant women, Senior citizens etc. a holistic study on the effect music in pre-hypertensive personnel is not available. Indian music has healing properties and it is relaxing. One of the unique practices of Indian music is rendering based on the ‘Time theory of *Ragas*’.

Hence, this study which is a repeated measure experimental randomized controlled design with 30 subjects has been undertaken to understand the effect of listening to Indian classical instrumental music based on the time theory of *Ragas* on pre-hypertensive patients. i.e. systolic blood pressure (BP) between 120 and 139 mmHg or diastolic BP between 80 and 89 mm Hg.

7. REVIEW OF LITERATURE

Review of literature for the current study on the “effects of music listening based on Indian time theory of *Ragas* pre-hypertensive on patients” was done under the following headings:

1. Why music therapy?
2. History of music therapy in India

3. Music therapy and hypertension
4. Effect of classical music in music therapy
5. Need for this study

7.1 WHY MUSIC THERAPY?

Music therapy as one of the life style changes is known to be effective for hypertensive and pre-hypertensive adults as complementary and alternative medicine. A study to evaluate the change in blood pressure after 3 months of music intervention combined with lifestyle modifications, in comparison with conventional lifestyle modifications yielded positive results.⁴ Main outcome measures were 24 hours ambulatory BP monitoring, stress levels, and biomarkers of hypertension. Mean (SD) of diastolic BP (DBP) pre and post intervention were overall = 85.1(6.8) and 83(8.7){P = 0.004}, awake = 87.7(7.6) and 85.9(9.2){P = 0.021}. Regression analysis showed association between diastolic BP change and post-intervention stress score in the music intervention group. Significant change in BP was seen among those who were pre-hypertensives prior to intervention. Thus, music decreased DBP and when used as an adjunct, benefitted subjects with initial BP in pre-hypertension range. However not much is known about effects of music therapy on cardiovascular vitals (BP, Respiratory rate and pulse rate) in this study.

7.2 HISTORY OF MUSIC THERAPY IN INDIA

Vedic chanting and the sound of drumming have their own healing properties. Indian traditional systems of health and healing also include various musical treatment approaches. A few healing traditions are also integrated in modern music therapy practices in India. All these approaches integrated with music not only for prayers, but also in *yoga* and meditation and guide the participant in the art of living. Vedic traditions dating back roughly 5000 years ago had a great intuition about the power of sound and intonation. The

Vedic chants and music which had more sound and rhythm, used as a source of healing and upliftment reflected the intuition that each intonation and inflection of voice are stated to have beneficial or adverse effects. Vedic chants were used by people to please the presiding deities. Different Vedic sacrifices to get benedictions of brilliance, power and wisdom to cure diseases were performed. Phrases from *Atharvana Veda* indicated that chanting was accompanied with drinking in a healing ceremony. Vedic hymns were also used against disease arising from hurtful changes of wind, bile or phlegm and for paying homage to lightning conceived as the cause of fever, headache and cough, to release the sufferer from head ache and cough. ⁵

Music is accepted as a holistic alternate medicine in the Mind Body medicine arena. *Raga Chikitsa*, an extinct Sanskrit treatise, as its name implies dealt with curative *Ragas* and suggested specific *Ragas* with specific therapeutic and mood enhancing characteristics. Dr. T V Sairam has mentioned in his study on designing training methods for the differently enabled children prescribed baseline rules for treating such children as – (1) Beta music with rapid fire orchestral rhythms to activate participation and anger management, to gear up physiological activities and alertness in mind, (2) Alpha music without rhythms to induce relaxation and (3) repeated rhythmic experience to regulate the wavering emotions and to bring regularity by his experimental observations during music therapy sessions with mentally retarded children. ⁶

In the medieval period, Tamil *Tevara Padhigams* (poems) were recited to cure specific diseases. Cure from ailments like Fever, Cold, Stomach pain and the like have been achieved by the Tamil Trinities of that period. E.g. *Ävvinnaikku evvinaai*” from Thiruneelakandar’s *Thirupadhikam*. Tamil poet Thirunavukaraser sang *“Kootraayinavaaru in Kolli pann* and got relief from his stomach pain at *“Thiruvadhikaai*”

near Cuddalore. The traditions depended not merely on the strength of doctrines proved through but also on spurious practices, including healing miracles.⁸

In the modern period of Indian music, the great composers of classical music in South India known as the 'Musical Trinity', who were also curiously the contemporaries of the 'Trinity of Western Classical Music, Bach, Beethoven and Mozart– were quite sensitive to the acoustical energies. Saint Thyagaraja brought a dead person back to life with his *Bilahari* composition *Naa Jiva Dhaara*. Muthuswamy Dikshitar's *Navagriha kriti* is believed to have cured stomach ache. Shyama Sastry's composition *Duru Sugu* uses music to pray for good health.⁹

In the recent past, a 27-year-old pregnant female with depression, improved with 20 sessions of receptive music therapy using Indian classical music. During music therapy, *Tridoshic* analysis of the patient showed progressive improving balance among the *Doshas* and Carroll Rating Scale for Depression fell from pre-treatment 16 to 5 at the end of 20 sessions. It seems that music therapy using Indian classical music integrating Time Theory of *Ragas* and principles of *Ayurveda* can offer a safe form of treatment for individuals with depressive symptoms.¹⁰

On the topic of the *Raga* and performance time, The Hindustani music tradition contains a very elaborate system of specific time associations for each *Raga*. The idea is that people are more or less receptive to certain *rasas* depending on the time of day. Therefore, playing a *Raga* at the right time is said to increase its emotional impact. In other words, successfully conveying an emotion requires not only a skilled musician and an appropriate vehicle (the *Raga*), but also an appropriate time frame.⁷ Pandit V N. Bhatkande, has further analyzed the rendering of time of *Ragas* based on the *Shuddha, Komal Swaras, Thivra madhyam* and the *Vadi swaras* in the *Raga*. *Vadi swara* being the life of Indian *Ragas* should be emphasized according to the time of the day. Expanding the concept

further, *Ragas* with multiple *vadi swaras* should be emphasized with the correct *vadi swara* based on the timing of the day. Such rendition is to enhance the emotional impact of the listener and the performer.¹² These time-based rendering of *Ragas* on plants have also been effective. However, rendering of *Ragas* based on the time theory is optional in the south Indian tradition according to the Musicologist Prof. P. Sambhamoorthy.¹³

Indian music has healing properties and can provide emotional upliftment in particular. Specifically, when a person is made to relax physically, emotionally and spiritually, it reflects in objective measurements like the human primary vitals in a positive manner.

7.3 MUSIC THERAPY AND HYPERTENSION

In a meta-analysis undertaken to investigate the effect of music in hypertensive patients, it has been concluded that music resulted in improvement in systolic blood pressure. Pre-hypertension subjects provided with music-listening along with life style changes, resulted in decreased DBP and benefitted subjects with initial BP in pre-hypertension range.¹⁴

In the study to determine the effectiveness of *Yoga*, Bio-feedback and Music Therapy in management of hypertension it states that music therapy resulted in positive changes in the psychological, physical, cognitive or social functioning of individuals.¹⁵ Listening to relaxing music can reduce BP and heart rates in hospitalized pre-hypertensive pregnant women during third trimester. The BP lowering effect of relaxing music listening is more significant for systolic BP.¹⁶

Music is one of the oldest and most basic socio-cognitive domains of the human species. Music therapy is growing as a profession globally. A research project was carried

out on fifty indoor patients admitted at Gupta Hospital, Hisar. All the patients, who received music therapy showed fast recovery from depressive symptoms and exhibited normal behavior after 5 days of Music Therapy. Music therapy had positive influence on the cognitive parameters and patients showed stable mind, better perception, improved expression, good intellect, fine decision-making ability and sharp memory after receiving music therapy. Music therapy administered for five days evoked fall in blood pressure and heart rate close to normal values in patients, who showed hypertension and tachycardia at the time of admission into the hospital. EEG was found to be normal in all the patients under study before and after music therapy. Furthermore, music therapy had positive influence on the cognition status and general behavior of patients. In conclusion, this study provides positive clinical evidence for the application of music therapy in managing patients suffering from depression. Music has the unique capability of bringing back the charm and making the life worth living for depressed patients.¹⁷

7.4 EFFECT OF CLASSICAL MUSIC IN MUSIC THERAPY

Turkish classical music had positive effects on both systolic and diastolic blood pressure in patients in senior care home with hypertension.¹⁸ While the psychological factors influenced by music is calmness and relaxation, some of the physical reflection of this impact can be measured by way of the Blood Pressure of the listener as well as from the reading of the Pulse rate and Respiratory Rate.¹⁹

The effects of *Raga Desi-Todi* played on flute was examined on three physiological (alpha EEG frequency, systolic and diastolic blood pressure and heart rate) and three psychological (depression, state and trait anxiety, and four components of anxiety: somatic, cognitive, behavioral and affective) assessments. The results showed that the instrumental

music led to a significant increase in the alpha EEG frequency and a significant decrease in the scores on depression, state and trait anxiety, and the four components of anxiety; the systolic and diastolic blood pressure. ²⁰

Music with faster tempo and rhythmic structures significantly increased ventilation, breathing rate, SBP and DBP and heart rate ²¹. Slower music like *Raga* induced a significantly large drop in heart rate. When the music was paused, heart rate, blood pressure, and ventilation decreased, sometimes even below the measurements at the beginning. None of the effects differed between the musicians.

7.5 NEED FOR THE STUDY

Hypertension is one the major issues for mankind and pre-hypertension could be an onset to the increase in Blood pressure. It is essential to take steps to get the Blood pressure reading back to a normal range to ensure that it does not lead to hypertension and the associated complications. Time and again, music has been proven as one of the life style enhancements that can help mankind to address this issue of pre-hypertension. Indian classical music based on the time theory of *Ragas* has properties to enhance emotional impact that music can bring in. However, there are no research evidence available on the application of the time-theory based *Ragas* to address medical conditions like pre-hypertension. This study is an attempt to provide music listening experience of melodies in the *Ragas* selected as per the Time theory concept. Sustained listening to these melodies is expected to bring down the BP reading.

8. RESEARCH METHODOLOGY

8.1 AIM AND OBJECTIVES

1. To find out if music listening intervention can reduce SBP, DBP, PR & RR in pre-hypertensive population visiting MGMCRI as outpatients.
2. To find out if listening to Indian classical music as per time theory of *Ragas* is beneficial
3. Compare the measures recorded between the two study groups namely, music listening group – Listening to Indian *Ragas* (instrumental music) based on time theory and Control group (receiving no music intervention) for SBP, DBP, PR & RR with pre-hypertensive patients.

8.2 HYPOTHESIS

There is a significant reduction in SBP, DBP, PR and RR after listening to music in the music listener group.

8.3 RESEARCH DESIGN

In this project, experimental research method has been deployed with one music listening group and one control group involving repeated measures of systolic blood pressure, diastolic blood pressure, pulse rate and respiratory rate.

8.4 RESEARCH SETTING

The study was conducted at Mahatma Gandhi Medical College and Research Institute.

8.5 POPULATION

This study was conducted with the help of out-patients of Mahatma Gandhi Medical College and Research Institute.

8.6 SAMPLE

Sample of the study consisted of 30 patients who were in the pre-hypertensive stage. They were taken into one of the two groups i.e. music listener group and Control group.

8.7 SAMPLING

Random allocation of subjects by computer assisted method was used as a sampling technique.

8.8. INCLUSION CRITERIA

- a) All male and female patients who visit MGMCRI and diagnosed with pre-hypertension
- b) 18 to 65 age group
- c) Who possess any one of the electronic devices like MP3 player / Smart phone / laptop / Computer to listen to music at home

8.9. EXCLUSION CRITERIA

All patients

- a) Having hearing loss
- b) Having any other medical / psychiatric disorder

8.10 PROCEDURE

Patients who visited the General Medicine – OPD and consented for the research were enrolled for the study on a daily basis. These patients satisfying the inclusion criteria were randomized to two groups, namely, music listener group and the control group. Subjects selected were not on medication of any kind. Control group subjects were requested to visit the Hospital once a week for taking reading of SBP, DBP, PR and RR. Patients falling under the control group were not provided any music to listen to.

Subjects of the music intervention group were advised to come for the music intervention for the next 30 days in a continuous manner. Conducive environment to listen to music was organized by the researcher, within the Hospital premises. Patients allocated to the music listener group received music intervention from the researcher every day. Music selected were Indian instrumental melodies based on time theory of *Ragas*. MP3 files were given to listen through head phones from audio players. MP3 files for the morning, afternoon and evening contained *Ragas* meant for the respective time of the day were named accordingly for ease of identification. Depending on the time the subjects visited, researcher facilitated listening to the appropriate music-*Raga*. E.g. *Raga Brindavani* between 12 noon to 2 pm, 4 to 6 pm being *Purvi* etc.

For every patient participating in the study, demographic details including occupation, place of residence, age and gender was collected. All patients recruited for the study were advised about the possible benefits of listening music as a life style modification.

For the music intervention group SBP, DBP, PR and RR were recorded before and after listening to the music in all the sessions every day for a period of 30 days. Weekly once, SBP, DBP, PR, and RR of patients of both the groups were recorded by the researcher. For control group, the same study parameters were recorded at the baseline and at the end of every week for a period of 30 days.

8.11 MUSIC INTERVENTION

The music used in the study was predominantly improvised *Raga* or *alap* music. Relaxation was the theme considered as a way to bring down the physiological measures observed during the study. Instrumental Hindustani classical music that represented slow tempo from instruments like the Sitar, Flute, Mandolin and violin were provided.

There were a set of 6 tracks selected by the researcher for the various timing. Multiple choices in the form of different musical instruments (mentioned above) was provided. Track details are provided in the appendix

8.12 ETHICAL CONSIDERATION

Informed consent form was obtained from all the participants from the study. The study was also approved by the committee created by the institute vide certificate of approval, Project No: PG DISSERTATION / 2017 /04/74 dated 13th April 2017.

9. RESULTS

The study has been analyzed in IBM SPSS statistics software using the t-test (paired and unpaired) and repeated measures ANOVA model of statistics and analysis.

The **results** from the statistical analysis were as follows. The details taken from the patient were name, gender, age, location and employment.

Table 1: Demographic Details of the music intervention and control group

GROUP		Sex	Occupation	age_code
1	N	15	15	15
	Mean	2.00	4.27	2.0667
	Std. Deviation	.000	.458	.70373
2	N	15	15	15
	Mean	1.33	5.13	2.0000
	Std. Deviation	.488	2.031	1.00000
Total	N	30	30	30
	Mean	1.67	4.70	2.0333
	Std. Deviation	.479	1.512	.85029

Note:

Group 1 - Music Group

Group 2 - Control group

Fig 1: Occupation Bar Chart

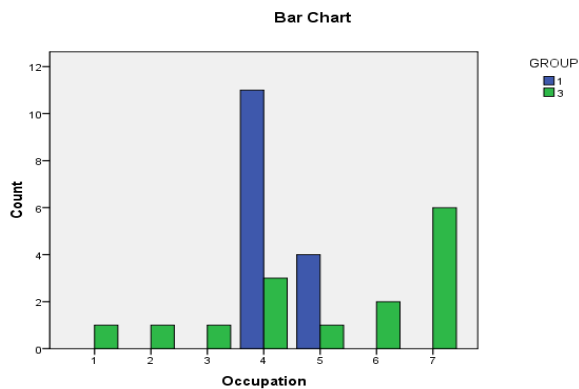


Fig 2: Gender Bar Chart

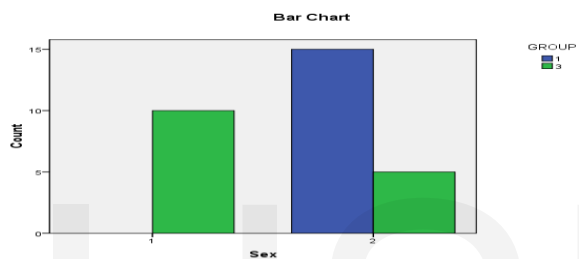


Fig 3: Age Bar Chart

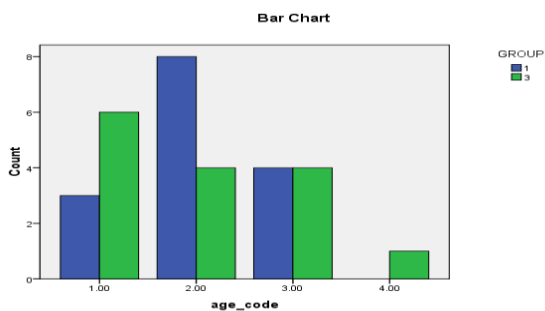


Table 2. SBP Measures in the Music Intervention group from 1st week to the 4th week.

SBP -Music Intervention group		Mean difference	Std Error	Sig
Week 1 – PRE	Week 1 – POST	5.200	.763	0.000
Week 2 – PRE	Week 2 – POST	6.867	1.597	0.001
Week 3 – PRE	Week 3 – POST	17.933	2.843	0.000

Week 4 – PRE	Week 4 – POST	15.600	1.718	0.000
--------------	---------------	--------	-------	-------

The above values indicate SBP of the music intervention group. Results indicate that there is significant reduction in SBP for the subjects of this group after all the four weeks.

Table 3: SBP Measures in the control group from 1st week to the 4th week.

SBP – Control group		Mean difference	Std. Error	Sig
Week 1 – PRE	Week 1 – POST	0.000	0.000	-
Week 2 – PRE	Week 2 – POST	0.267	1.364	0.848
Week 3 – PRE	Week 3 – POST	-1.733	0.853	0.062
Week 4 – PRE	Week 4 – POST	-3.000	0.951	0.007

The above values indicate SBP of the control group. Results indicate that there is no significant difference up to week4. Week4 indicates significant increase in SBP of the control group.

Table 4: DBP Measures in the Music Intervention group from 1st week to the 4th week.

DBP – Music intervention group		Mean difference	Std. Error	Sig
Week 1 – PRE	Week 1 – POST	4.067	0.643	0
Week 2 – PRE	Week 2 – POST	6.000	1.407	0.001
Week 3 – PRE	Week 3 – POST	13.600	3.126	0.001
Week 4 – PRE	Week 4 – POST	4.533	1.778	0.023

The above values indicate DBP of the music intervention group. Results indicate that there is significant reduction in DBP for the subjects of this group.

Table 5: DBP Measures in the control group from 1st week to the 4th week.

DBP – Control group		Mean difference	Std. Error	Sig
Week 1 – PRE	Week 1 – POST	0	0	-
Week 2 – PRE	Week 2 – POST	-1.467	1.195	0.24
Week 3 – PRE	Week 3 – POST	0.6	0.95	0.538
Week 4 – PRE	Week 4 – POST	-2.2	1.029	0.051

The above values indicate DBP of the control group. Results indicate that there is no significant reduction of DBP in this group.

Table 6: PR Measures in the Music Intervention group from 1st week to the 4th week.

PR – Music intervention group		Mean difference	Std. Error	Sig
Week 1 – PRE	Week 1 – POST	0.6	0.844	0.489
Week 2 – PRE	Week 2 – POST	1.067	1.382	0.453
Week 3 – PRE	Week 3 – POST	2.133	2.72	0.446
Week 4 – PRE	Week 4 – POST	0.8	1.405	0.578

The above values indicate PR of the music intervention group. Results indicate that there is no significant difference in PR for the subjects of this group.

Table 7: PR Measures in the control group from 1st week to the 4th week.

PR – Control group		Mean difference	Std. Error	Sig
Week 1 – PRE	Week 1 – POST	0	0	-
Week 2 – PRE	Week 2 – POST	-0.133	1.179	0.912
Week 3 – PRE	Week 3 – POST	0.2	1.328	0.882
Week 4 – PRE	Week 4 – POST	-1.733	1.213	0.175

The above values indicate PR of the control group. Results indicate that there is no significant difference in PR for the subjects of this group.

The RR values in the music intervention group did not indicate any significant reduction in the music intervention group. The RR values of the control group indicated that the respiratory rates increased though not significantly.

10. DISCUSSION

Results indicate that DBP and SBP of the music listener group have significant reduction, after the musical intervention of 30 days. PR and RR values have reduced but not significantly. Control group on the other hand shows a gradual increase the SBP, DBP, PR and RR values over the same period. Regular listening to classical, relaxing music has helped pre-hypertensive patients and resulted in controlling of the SBP, DBP, PR and RR reading in them. This is in consonance with the earlier finding of using Indian classical music integrating time theory of *Ragas* and principles of *Ayurveda* to offer a safe form of treatment for individuals with depressive symptoms¹⁰ and the study undertaken to determine the effectiveness of *Yoga*, Bio-feedback and music therapy in management of hypertension¹⁵ The results are also in consonance with the meta-analysis undertaken to investigate the effect of music in hypertensive patients¹⁴. Time theory of *Ragas* has contributed in this process of musical intervention positively. However, the mechanism of how time theory of *Ragas* contributed to the positive effect of reduction of blood pressures have not been explored.

LIMITATIONS:

The effectiveness of listening to classical music not in consonance with the time theory of *Ragas* has not been explored. The mechanism behind the positive effect of time theory has not been explored. The circadian rhythmic aspect of blood pressure has not been

taken into account in this study which is an important limitation. The study had a small sample size of 30 subjects which did not have the sufficient power to generalize the results. A major challenge was recruiting pre-hypertensive out patients within 3 months, in a tertiary care hospital like MGMCRI. Hence, identified subjects were provided daily music intervention in a conducive environment within the hospital premises.

11. CONCLUSION

Pre-hypertension is a precursor to hypertension and needs to be kept in check to avoid the dangers of hypertension. This study was an attempt to find out if listening to music could help reduce BP in pre-hypertensive population, thereby reducing their chances of becoming hypertensive. Music listening can be a life style modification therapy in maintaining or returning to normal BP.

There are no music interventional studies with pre-hypertensive population using the time theory of *Ragas*, conducted so far and this study gives us a direction to future studies and also could overcome the challenges faced by the researcher. The results of this study recommend music therapy as a complementary therapy to pre-hypertensive patients to alleviate their anxiety and stress levels for controlling BP.

Further studies could be replicated taking into account circadian rhythmic nature of BP and probe mechanisms to explain positive effects of listening to music in consonance with the time theory of *Ragas*.

12. REFERENCES

1. Brahmam GN. Diet and nutritional status of population and prevalence of hypertension among adults in rural areas. National Institute of Nutrition Hyderabad. 2006;143.

2. Parthaje PM, Unnikrishnan B, Thankappan KR, Thapar R, Fatt QK, Oldenburg B. Prevalence and correlates of prehypertension among adults in urban South India. *Asia Pacific Journal of Public Health*. 2016 Jan;28(1_suppl):93S-101S.
3. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo Jr JL, Jones DW, Materson BJ, Oparil S, Wright Jr JT, Roccella EJ. The seventh report of the joint national committee on prevention, detection, evaluation, and treatment of high blood pressure: the JNC 7 report. *Jama*. 2003 May 21;289(19):2560-71.
4. Kunikullaya KU, Goturu J, Muradi V, Hukkeri PA, Kunnivil R, Doreswamy V, Prakash VS, Murthy NS. Combination of music with lifestyle modification versus lifestyle modification alone on blood pressure reduction—A randomized controlled trial. *Complementary therapies in clinical practice*. 2016 May 31;23:102-9
5. Sundar S. Traditional healing systems and modern music therapy in India. *Music Therapy Today*. 2007 Dec;8.
6. Sairam TV. Music therapy: Designing training methods for the mentally retarded (MR) children. *Music Therapy: The Sacred and the Profane*. Chennai: Nada Centre for Music Therapy. 2006:74-8.
7. Brabant O, Toiviainen P. Diurnal changes in the perception of emotions in music: Does the time of day matter?. *Musical Scientiae*. 2014 Sep;18(3):256-74.
8. SJ VS. Jaina Insights in Tamil Classical Literary Tradition. புதிய பனுவல்: An International Journal of Tamil Studies. 2009;1(04).
9. Sundar S. Traditional healing systems and modern music therapy in India. *Music Therapy Today*. 2007 Dec;8.
10. Sumathy S, Pavitra D. INDIAN CLASSICAL MUSIC AS RECEPTIVE MUSIC THERAPY IMPROVES TRIDOSHIC BALANCE AND MAJOR DEPRESSION IN A PREGNANT WOMAN. *International Journal of Ayurveda and Pharma Research*. 2016 Oct 2;4(9).
11. Batish SD, Batish A. *Ragopedia: Exotic scales of North India (volume 1)*.
12. Nayar S. *Bhatkhande's contribution to music: a historical perspective*. Popular Prakashan; 1989.
13. Sambamoorthy P. *South Indian Music Book I*. The Indian Music Publishing House, Madras; 1951.
14. do Amaral MA, Neto MG, de Queiroz JG, Martins-Filho PR, Saquetto MB, Carvalho VO. Effect of music therapy on blood pressure of individuals with hypertension: A

- systematic review and Meta-analysis. International journal of cardiology. 2016 Jul 1;214:461-4.
15. Desai F, Vyas O. Study of determine the effectiveness of yoga, biofeedback music therapy in management of hypertension. Indian J Occup Ther. 2001;33(2):3-7.
 16. Sumathy S, Ramesh B. Effect of relaxing music on blood pressure and heart rate in hospitalized pre-hypertensive women in 3rd trimester of pregnancy – A randomized control study; 2015 Sep.
 17. Arya A, Parle M. ANTI-DEPRESSANT POTENTIAL OF MUSIC THERAPY; March 2010
 18. Bekiroğlu T, Ovayolu N, Ergün Y, Ekerbiçer HÇ. Effect of Turkish classical music on blood pressure: a randomized controlled trial in hypertensive elderly patients. Complementary therapies in medicine. 2013 Jun 30;21(3):147-54.
 19. Krout RE. Music listening to facilitate relaxation and promote wellness: Integrated aspects of our neurophysiological responses to music. The arts in Psychotherapy. 2007 Dec 31;34(2):134-41.
 20. Gupta U, Gupta BS. Psychophysiological responsivity to Indian instrumental music. Psychology of Music. 2005 Oct;33(4):363-72.
 21. Bernardi L, Sleight P. Music can reduce Blood Pressure, Depending on the Tempo. 2005

14. APPENDICES

LIST OF TRACKS USED

Timing	Raga
6 to 8 am	Bhairav or Mayamalava Gowlai
8 to 10 am	Ahir Bhairav or Chakravaham
10 to 12 noon	Bhairavi or Sindhu Bhairavi
12 noon to 2 pm	Brindavani Sarang

4 to 6 pm	Poorvi
8 to 10 pm	Desh

IJSER