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Original Research Article

Effects of Hamsadhwani music on heart rate variability: Gender discrepanciesC V Vaishali^{*#1}, M Arunkumar^{#2} and K C Latha³¹Ph.D. student, Division of Biotechnology and Bioinformatics, Department of Water and Health, JSS Academy of Higher Education and Research, Mysore, India²Senior Research Fellow, PG and Research Department of Environmental Science, PSG College of Arts and Science, Coimbatore, India³Assistant Professor, Division of Biotechnology and Bioinformatics, Department of Water and Health, JSS Academy of Higher Education and Research, Mysore, India

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Abstract

Cardio-vascular diseases are more widespread around the world. Music therapy is a recent treatment methodology utilized to treat mental illness, depression, and anxiety. Listening to music can help to calm our minds and to control high blood pressure. The objective of this study is to analyze the effect of Hamsadhwani music on cardiovascular parameters – Systolic and diastolic Blood pressure and pulse rate. 75 healthy subjects including, 41 males and 34 Females have participated in the study. Blood pressure and pulse rate were measured pre- and post-exposure to hamsadhwani music and the collected data was exposed to various statistical analyses. We observed that there is a significant reduction in the blood pressure and pulse rate when hearing Hamsadhwani music. On an average of about 11.51, 6.56 and 8.13 percentage of reduction in SBP, DBP and Heart rate were observed. When analyzing the data concerning sex, the female group showed a high reduction rate than the male subjects. Our results suggest that Hamsadhwani music has the potential to reduce blood pressure and can be a part of the programs preventing cardiovascular disease.

Keywords: Carnatic Music, Music therapy, Blood Pressure, CVD.***Correspondence Info:**

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1. Introduction

Cardiovascular diseases (CVDs) are the leading cause of mortality around the world. Especially in India, around 28.1% of all mortality is attributable to CVD [1]. Cardiovascular mortality became more common in men than in women. Females are less susceptible to cardiac issues due to parasympathetic dominance, whereas vagal inhibition along with sympathetic activation favors the vulnerability of males to CVD [2]. Recent clinical studies have been revealed that illness and death associated with cardiovascular diseases can be minimized by a slight reduction in blood pressure [3]. In this concern, various preventive programs being conducted to minimize the development of CVD based on modification in lifestyle.

Music has been used since ancient times to influence human health. In recent times music has been used as a modern treatment. There is growing research evidence regarding the use of music therapy such as singing, music listening, musical improvisation, and other musical activities for the treatment of mental illness, and has been widely used to treat anxiety and depression[3-5]. Wu *et al* [6] analyzed the effects of music listening on anxiety and physiological responses in patients undergoing awake craniotomy and concluded that just lay down was insufficient to relieve anxiety. At the same time, receiving music intervention was much useful to reduce anxiety. Previous clinical studies also proved that music has immense restorative supremacy to cure insomnia [7].

The individual relaxation response to music is affected by music genre, which is composed of different basic compositional elements, such as melody, rhythm, harmony, and tonality. Music can simulate different psychological effects on human the body based on variations in the tempo or beats. Studies also have shown that the music of fast tempo (120–130 bpm) can increase blood pressure and heart rate whereas slow tempo music (50–60 bpm) showed an opposite effect [8]. Hence Fast beat rock music widely used to facilitate physical and athletic activity [9] and slow soft music used to treat depression and anxiety [10]. Slow, non-lyrical and flowing music with 60-80 beats per minute suggestively have positive outcomes on relaxation and pain relief which is extremely suitable for therapeutic purposes [11].

One of the musical scales of Carnatic music of Indian tradition is Hamsadhwani, which means Sound of Swans. It is both pentatonic and derived scale music. This raga is also widely used in Hindustani music. Generally, Hamsadhwani raga known to promote happiness in individuals, hence it is widely used in temples. Several studies were previously conducted to find out the effects of slow music on the patients before and after major surgery or treatment. However, the best of our knowledge, no study employed Hamsadhwani raga as a relaxation agent on healthy subjects. The objectives of this study were to investigate the effects of Hamsadhwani, Carnatic music on cardiovascular rhythms-systolic and diastolic blood pressure and pulse rate in individuals. Moreover, the objectives were extended to statistically discuss the influence of gender differences in response to Carnatic music.

2. Materials and methods

This was a cross-sectional study done in the JSS Medical college campus, by faculty of Life sciences, Division of Biotechnology & Bioinformatics. About 75

healthy participants (41 males and 34 females) with the age group of 18-67 years were randomly selected for this study. Subjects with deafness, cardiovascular disorders, stroke, seizure, shock and treatment with drugs that modify cardiac autonomic regulation were excluded from the study. After obtaining informed written consent, a detailed history was taken, and a clinical examination was done. The anthropometric parameters such as height, weight were measured, and BMI was calculated using Quetelet's index. The subject was made to lie down comfortably on a couch and allowed to take rest for five minutes, Then the baseline pulse rate and blood pressure are measured by LED BP apparatus, The hamsadwani music was played through the headphone for 3 mins, Immediately after the music stops, the pulse rate and blood pressure were measured within an interval of 30 seconds.

2.1 Statistical analysis

An overall representation was done for each of the variables considered. For quantitative variables, mean, standard deviation, median, minima and maxima of each modality were determined. The pulse rate and blood pressure recorded pre-exposure and post-exposure to Hamsadhwani music were analyzed using Students Paired t-test. P-value of less than 0.05 was considered significant. Statistical analysis was performed using Microsoft Excel and SPSS version 22.

3. Results and Discussion

75 healthy people have participated in the study. Out of this, 41 are male and 34 are female. The blood pressure and the pulse rate were measured before and after exposure to Hamsadhwani music. The collected data were analyzed by mean and standard deviation using standard t-test.

The biophysical statistics of the study group such as Age, height, weight, and Body Mass Index (BMI) are presented as mean and standard deviation in Table 1.

Table 1: Bio-Physical profile of the study group

	Participants	Age (Years)	Height (cms)	Weight (Kgs)	BMI
Male	41	31.63	167.24	64.54	23.04
Female	34	28.88	159.41	52.83	20.78
Overall	75	30.39	163.69	59.23	22.02

3.1 Effects of Hamsadhwani Music

Table 2: Comparison of pulse rate and blood pressure between pre- and post-exposure to Hamsadhwani music

Parameters	Pre-Exposure				Post-Exposure				P-Value
	Min	Max	Mean	SD	Min	Max	Mean	SD	
SBP (mmHg)	95	150	119.29	12.37	80	127	105.45	12.38	0.000*
DBP (mmHg)	54	96	70.4	9.17	45	84	65.67	9.65	0.000*
Pulse rate (bpm)	50	98	80.29	10.69	54	88	73.48	9.19	0.000*

* Significant at 0.01 level

Table 2 provides the experimental data on pre- and post-exposure effects of Hamsadhvani music on pulse rate, systolic and diastolic blood pressure. The mean values of pulse rate ($p < 0.001$), the SBP ($p < 0.001$), the DBP ($p < 0.001$) were found to be significantly reduced after listening to music. Upon the intervention of music systolic blood pressure was reduced from pre-exposure level of 119.29 (range 95-150) mmHg to 105.45 (80-127) mmHg just after the music. Likewise, significant reductions were noted in diastolic blood pressure immediately post-exposure to classical music from 70.4 ± 9.17 to 65.67 ± 65.67 mmHg. Similarly, notable changes were observed in the pulse rate just before and after the music intervention. The Pre-music exposure level of pulse rate ranged from 50-98, with an average of 80.29 bpm, which was reduced to about 73.48 bpm, ranged between 54-88 bpm. This effect may be due to the action of music through the parasympathetic nervous system. Earlier studies also reported that music decreases sympathetic tone and muscle tension and regulate heart rate [9]. These results are consistent with those of other studies [2,5,12-14]. These findings are in agreement with the study by Siritunga *et al.*[3] on asymptomatic individuals aged between 45 and 65 years, which highlighted that listening to Indian classical music for about 22 minutes may result in significant reductions of SBP, DBP and pulse rate. Results of the current research match those observed in an earlier study which reported that listening to slow music there results in the decrease of 7.12 mmHg in the mean Systolic blood pressure and 3.86 mmHg in the mean diastolic blood pressure[15]. These results were also are in consistent of the conclusions of Suguna and Deepika[5]. They pointed out that listening to slow music not only keeps us relax and happy, it can be also a benefit the health by restraining the cardiovascular rhythms. In the same way, it was suggested that listening to “relaxing” music for 3 minutes may yield a decrease in Heart Rate, Blood Pressure with a shift of cardiac variation in the direction of more parasympathetic and less sympathetic modulation [16]. A Similar study [10] demonstrated that Classical Turkish Music, natural sounds and Classical Western Music are effective in keeping blood pressure and serum cortisol levels under controlled limits and can reduce the preoperative anxiety of patients. Latha *et al.*[12] had also shown that classical music may have a beneficial effect on HRV and reduces the stress level.

3.2 Gender Differences in the effect of Music

Findings of pre-exposure and post-exposure effects of Hamsadhvani music on pulse rate, systolic blood pressure and diastolic blood pressure among males was illustrated in figure 1. As shown in the figure, after listening to Carnatic music, a significant reduction in the pulse rate, SBP and DBP was observed, which ultimately suggesting a shift in the direction of boosted vital activity. The average SBP and DBP among the males of the study group were found to be 123.98 and 71.41 mmHg pre-exposure to

music. Interestingly, after listening to music the blood pressure was significantly reduced to 110.39 and 67.12 mmHg for SBP and DBP, correspondingly. Likewise, pulse rate also found to be reduced with the effect of music.

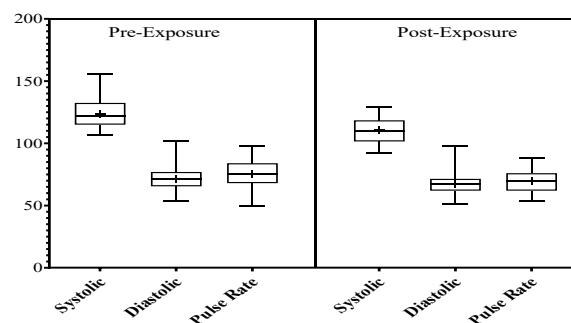


Figure 1: Comparison of pulse rate and blood pressure between pre-exposure and post-exposure to music among Males

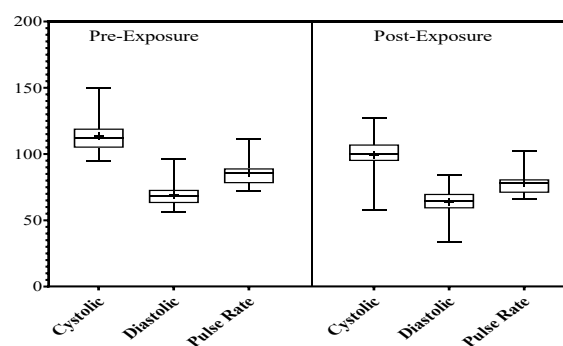


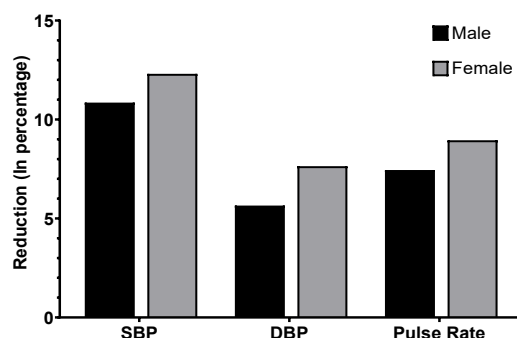
Figure 2: Comparison of pulse rate and blood pressure between pre-exposure and post-exposure to music among the female's group

The effect of music on pulse rate, SBP, and DBP of the female group were graphically represented in figure 2. A Rapid reduction in Systolic blood pressure was observed in the female group. The SBP and DBP level was found to be 113.65 and 69.18 mmHg, just before music exposure and 99.50 and 63.91 mmHg, after exposure to music, respectively. Table 3 compares the summary statistics of the changes caused by the music exposure on study participants. The observations revealed that there are significant changes in all the variables after exposure to Hamsadhvani Carnatic music. It can be seen from table 3, between two gender groups, both SBP and DBP were lower in the females when compared to the male group. In contrast to that, the pulse rate was observed to be high in the female group with that of the male participants. The mean Pulse rate was changed from 75.78 to 69.68 and 85.74 to 78.06 bpm for male and female participants respectively. Compared to pre-exposure, after exposure to Hamsadhvani music a significantly greater decrease in Systolic Blood Pressure (difference in means: male – 13.585, Female–14.147, $P < 0.001$), Diastolic Blood Pressure (difference in means: male - 4.293, female 5.265, $P < 0.001$), and pulse rate (difference in means: male – 6.098, female – 7.677, $P < 0.001$) were observed throughout the study.

Table 3: Effects of exposure to Hamsadhwani music on cardiovascular parameters

Parameters	Pre-Exposure	Post-Exposure	Correlation	Paired t-Test		
	Mean \pm SD	Mean \pm SD		Mean Difference	t	P-Value
Male (N = 41)						
SBP (mmHg)	123.98 \pm 10.84	110.39 \pm 10.28	0.774	13.585	12.229	0.000*
DBP (mmHg)	71.42 \pm 9.54	67.12 \pm 9.06	0.771	4.293	4.356	0.000*
Pulse Rate (bpm)	75.78 \pm 10.43	69.68 \pm 7.81	0.838	6.098	6.767	0.000*
Female (N=34)						
SBP (mmHg)	113.65 \pm 11.87	99.50 \pm 12.20	0.710	14.147	9.000	0.000*
DBP (mmHg)	69.18 \pm 8.70	63.91 \pm 10.17	0.771	5.265	4.699	0.000*
Pulse Rate (bpm)	85.74 \pm 5.30	78.06 \pm 8.71	0.871	7.677	10.315	0.000*

Generally, there are differences between men and women regarding their physiological responses to the musical acoustic stimulus [17]. Figure 1 show the average percent decrease was slightly greater in females when compared to males after listening to slow music. on average 12.31 and 7.64% of the decrease in SBP and DBP was observed in females, whereas males show only about 10.85 and 5.65% reduction for the same. In the case of pulse rate, about 7.45 and 8.95 % of the reduction was observed. Several studies [2,5,18,19] reported that females respond more positively to relaxing music than the males. The present findings seem to be consistent with Latha *et al.*[2] that revealed that reduction HRV parameters are significantly high in the female population than the male population. The impact of music listening on the biopsychological anxiety indicators in male and female are different. Specifically, music listening reduces cortisol levels in females whereas in males, it increased the alpha-amylase level [19]. It is evident that the slow rhythms of the music can reduce the secretion of catecholamines and the activity of the autonomic nervous system to result in the reduction of heart rates [6]. A study by Mitchell *et al.*[20] demonstrate that listening to their preferred music, participants can tolerate the painful stimulus significantly longer when compared with relaxation music and control conditions. However, the intensity of pain is significantly lower in females than males. This is attributed to parasympathetic enhancement in females which results in a larger decrease in heart rate and blood pressure than males [5].

**Figure 4: Percent decrease in pulse rate and blood pressure by male and female group post-exposure to Hamsadhwani music**

4. Conclusion

The present study designed to determine the effects of listening to Hamsadhwani music on Blood pressure and pulse rate. The results of the investigation showed that there is a significant reduction in the blood pressure and pulse rate when exposed to Carnatic music. On an average of about 11.51, 6.56 and 8.13 percentage of reduction in SBP, DBP and Heart rate were observed. The evidence from this study suggests that Hamsadhwani music can be a part of the programs preventing cardiovascular disease. Moreover, music listening would be a more attractive intervention method and it is much cost-effective, which may help to avoid the health-related financial burden in forthcoming. A limitation of this study is that the numbers of subjects were relatively small, narrow age group of participants, the use of only one type of music and lack of consideration of other factors. In the future, conducting researches to find out the effect of long term listening to the music on the occurrence and the diagnosis of CVD is also important. Besides, research needs to account for a large number of subjects which will allow for subgroup analysis by factors such as age, gender, ethnicity, and individual healthcare.

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