

**Effect of two Genre of Music on Heart Rate Variability in first year MBBS Students of P.M.C.H., Patna**Shanta Kumari<sup>1</sup>, Harshwardhan<sup>2</sup>, Rajiva Kumar Singh<sup>3</sup><sup>1</sup>Tutor, Department of Physiology, Patna Medical College, Patna Bihar, India<sup>2</sup>Tutor, Department of Physiology, Patna Medical College, Patna Bihar, India<sup>3</sup>Professor & HOD, Department of Physiology, Patna Medical College, Patna, Bihar, India

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**Abstract****Aim:** The aim of the present study was to assess the effect of music on frequency domain measures of heart rate variability (HRV) in medical students.**Methods:** The study was conducted on twenty randomly selected first year MBBS Student of age group 17-21 yrs., both genders. They were exposed to two musical excerpt of ten minute duration of different genres of music that is slow melody and fast rhythm music during which Heart Rate Variability indices were continuously monitored.**Results:** The music group demonstrated a significant decrease in heart rate ( $P < 0.0001$ ), mean arterial pressure ( $P < 0.02$ ) and rate pressure product ( $P < 0.01$ ) compared with non-music group. The music group showed a significant decrease in HR ( $P < 0.0001$ ), mean arterial pressure ( $P < 0.02$ ) and rate pressure product (RPP) ( $P < 0.01$ ) compared with nonmusic group. The TP which is the marker of the magnitude of HRV and HFnu were significantly increased ( $P < 0.0001$ ) in the music group compared with nonmusic group. But the LFnu was decreased significantly ( $P < 0.0001$ ) in the music group compared with nonmusic group. Furthermore, the LF/HF ratio was significantly decreased ( $P < 0.0001$ ) depicting the decreased sympathetic activity and increased parasympathetic activity in the music group compared with nonmusic group. The LF-HF ratio was not significantly correlated with TP and stress score in both the music and non-music groups.**Conclusion:** In the present study, music therapy could reduce the stress levels in the medical students. Therefore, this study provides the preliminary evidence that listening to classical music could be an effective method of relaxation, as indicated by a shift of the autonomic balance towards the parasympathetic activity among medical students.**Keywords:** Autonomic balance, heart rate variability, music

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**Introduction**

It has been known for centuries that music has an effect on human beings. [1,2] Studies have investigated the influence of music in the setting of different clinical symptoms/conditions, surgical procedures, or in pain management and palliative medicine. [3-5] In 2009, Bernardi et al [6] published a study that met with much attention, which had analyzed the effect of music on cardiocirculatory parameters in 24 volunteers.

Modern medicine today prefers an individual, highly specific approach to the patient. With the development of a wide range of diseases of civilization, other diseases and disabilities, non-invasive medicine, in the form of various complementary therapies, has gradually found a place in the process of diagnosis and treatment. A relatively unexplored area is music therapy, the so-

called music therapy. Stimulation of the auditory system with music is gaining more and more attention in the treatment and prevention of disorders. According to the currently available evidence in individual studies, music in the individual primarily attracts attention, can suppress a number of emotions, changes or regulates mood, increases work performance, stimulates arousal, induces the functioning of higher nervous functions, regulates inhibitions, supports rhythmic movement, and others. [7] Musical auditory stimulation, thus, evokes a diverse range of psycho - logical and hemodynamic expressions by influencing the autonomic regulation of cardiac activity.

The autonomic nervous system is the main regulatory system that ensures flexibility, homeostasis, and adaptability of the body during rest

but also in stressful situations. Its centers are located in the cortical (cerebral cortex) and subcortical areas (spinal cord, brain stem, hypothalamus, etc.) and its activity in general cannot be controlled by will. From a functional point of view, it consists of two units: pars sympathica and pars parasympathica, which in principle work antagonistically. This system is involved in the management and control of all vital processes (internal organ activity, homeostasis, smooth muscle function, heart and gland function, metabolism, and vital physiological functions). [8] The current insufficient number and quality of studies does not make it possible to unambiguously determine when and under what conditions music therapy is therapeutically effective. [9,10]

The aim of the present study was to assess the effect of music on frequency domain measures of heart rate variability (HRV) in medical students.

### Materials and Methods

The study was conducted on twenty randomly selected first year MBBS Student of age group 17-21 yrs., both genders. They were exposed to two musical excerpt of ten minute duration of different genres of music that is slow melody and fast rhythm music during which Heart Rate Variability indices were continuously monitored.

The students were randomly divided by simple randomization method into two groups viz., music group (n = 10) and non-music group (n = 10). A short medical history from the students revealed that they were not on any medication for anxiety, depression and systemic illness; and they had no aversion towards music.

The ethical approval for the study was obtained from the Institutional Ethics Committee. Informed consent was obtained from the medical students before the commencement of the study. The participants in the music group were asked to listen to a preselected classical music (Rag Bilahari)<sup>11</sup> for 30 minutes daily for one month in sitting posture with the aid of earphones. An electrocardiogram (ECG) record (5 minutes), using PHYSIOPAC- PP4 software was obtained prior to music intervention in both the groups. The basal cardiovascular parameters such as heart rate (HR), blood pressure and the frequency domain parameters of HRV such as total power (TP), low frequency normalized unit (LFnu), high frequency normalized unit (HFnu) and low frequency-high frequency (LF/HF) ratio, were measured in both music and non-music groups. The stress level was assessed using perceived stress scale (PSS) in the music group alone before and after music intervention. The PSS scale is a widely used psychological instrument to measure perception of stress, in which subjects have to answer 10 questions (items) related to feelings and thoughts experienced as stress during the last one month. The score for each item ranges from 0 = Never, 1 = Almost Never, 2 = Sometimes, 3 = Fairly Often, 4 = Very Often. Reverse coding is done for items 4,5,7 and 8. The total score ranges from 0 to 40. The subjects with high PSS score are considered to have stress.<sup>12</sup>

### Statistical Analysis of Data

The data were expressed as mean  $\pm$  SD. To test the significance, unpaired 't' test (using SPSS version 17) and Pearson's correlation analysis were applied. The statistical probability  $P < 0.05$  was considered to be significant.

### Results

**Table 1: Age, BMI and basal cardiovascular parameters of the subjects in music and nonmusic groups**

Parameters	Musicgroup	Non-music group	P value
Age (years)	18.12 $\pm$ 0.54	19.04 $\pm$ 0.66	0.314
BMI (kg/m <sup>2</sup> )	21.7 $\pm$ 4.16	22.8 $\pm$ 4.46	0.245
HR (bpm)	66.94 $\pm$ 8.92	70.05 $\pm$ 9.21	0.350
SBP (mmHg)	120 $\pm$ 8.3	122 $\pm$ 6.6	0.284
DBP (mmHg)	76 $\pm$ 4.6	81 $\pm$ 6.4	0.112
RPP (mmHg)	82.4 $\pm$ 15.5	85.65 $\pm$ 10.2	0.259

The music group demonstrated a significant decrease in heart rate ( $P < 0.0001$ ), mean arterial pressure ( $P < 0.02$ ) and rate pressure product ( $P < 0.01$ ) compared with non-music group.

**Table 2: Cardiovascular parameters and frequency domain indices of HRV in both the music and non-music groups following music therapy**

Parameters	Music group	Non-music group	P value
HR (bpm)	56.4 $\pm$ 7.23	71.5 $\pm$ 12.58	0.0001
MAP (mmHg)	86.4 $\pm$ 8.2	91.9 $\pm$ 10.5	0.0200
RPP (mmHg)	77.3 $\pm$ 10.9	83.2 $\pm$ 9.3	0.0100
TP (ms <sup>2</sup> )	2052.8 $\pm$ 751.36	1568.6 $\pm$ 475.85	0.0001
LFnu	52.58 $\pm$ 12.04	68.45 $\pm$ 2.95	0.0001
HFnu	44.36 $\pm$ 12.02	32.58 $\pm$ 2.92	0.0001
LF/HF ratio	1.16 $\pm$ 0.52	1.96 $\pm$ 1.14	0.0001

The music group showed a significant decrease in HR ( $P < 0.0001$ ), mean arterial pressure ( $P < 0.02$ ) and rate pressure product (RPP) ( $P < 0.01$ ) compared with nonmusic group. The TP which is the marker of the magnitude of HRV and HFnu were significantly increased ( $P < 0.0001$ ) in the music group compared with nonmusic group. But the LFnu

was decreased significantly ( $P < 0.0001$ ) in the music group compared with nonmusic group. Furthermore, the LF/HF ratio was significantly decreased ( $P < 0.0001$ ) depicting the decreased sympathetic activity and increased parasympathetic activity in the music group compared with nonmusic group.

**Table 3: Correlation of LF-HF ratio with total power and stress score in both music and non-music groups**

Days	Music group		Non-music group	
	r	P	r	P
Total power	-0.084	0.580	0.146	0.375
Stress score	0.180	0.2715	-0.0178	0.921

The LF-HF ratio was not significantly correlated with TP and stress score in both the music and non-music groups.

### Discussion

Autonomic nervous system (ANS) regulates the function of various systems in human body to maintain homeostasis and adaptation to stressful situations. The autonomic functions are not normal even in healthy subjects, because of routine stress, which has become an integral part of the modern lifestyle. The education in medical colleges is recognized as stressful, that can exert negative effect on physical health of students. [13] Studies on stress among medical students have identified three main reasons for stress such as academic pressures, social issues and financial problems. [14] The factors causing stress vary with the time spent in medical training, concern about workload and personal competence, which seems particularly more pronounced in the first year. [15,16] Depression and anxiety are associated with concerns about mastering knowledge, personal endurance and lack of time for other activities. [17]

It is an indisputable fact that music has gradually found its way and application in the field of medicine. The main goals of therapists in the broadest spectrum are to encourage the patient to express and release their own emotions, to help with stress or anxiety situations associated with everyday life or directly with the diagnosis, to improve mood and, finally, the overall quality of life. As Javorka et al. noted, in addition to the well-known regular physical exercise and sport, various relaxation methods as well as slow breathing training associated with music therapy have been used for a long time in autonomic as well as emotional dysfunction, as well as in the treatment of pain, anxiety symptoms, and other conditions. [18] The music group demonstrated a significant decrease in heart rate ( $P < 0.0001$ ), mean arterial pressure ( $P < 0.02$ ) and rate pressure product ( $P < 0.01$ ) compared with non-music group. The music group showed a significant decrease in HR ( $P < 0.0001$ ), mean

arterial pressure ( $P < 0.02$ ) and rate pressure product (RPP) ( $P < 0.01$ ) compared with nonmusic group. This shows the possibility of the autonomic balance shifting towards the improvement of parasympathetic tone. The results of our study are in agreement with the study of Lee et al [19] on effect of music on preoperative patient's anxiety, where the music group showed a significant reduction in low-frequency power of HRV and LF/HF ratio and a significant increase in high frequency power of HRV compared with the control group.

The TP which is the marker of the magnitude of HRV and HFnu were significantly increased ( $P < 0.0001$ ) in the music group compared with nonmusic group. But the LFnu was decreased significantly ( $P < 0.0001$ ) in the music group compared with nonmusic group. Furthermore, the LF/HF ratio was significantly decreased ( $P < 0.0001$ ) depicting the decreased sympathetic activity and increased parasympathetic activity in the music group compared with nonmusic group. The LF-HF ratio was not significantly correlated with TP and stress score in both the music and non-music groups. The results of our study goes in agreement with the recent report of Pal et al [20] who have clearly depicted that TP and HF power were increased following a short-term relaxation therapy (shavasana with music therapy) and thus demonstrated the improvement of autonomic balance by the short-term relaxation therapy. These effects are further supported by a study of Lin et al [21] where he had provided an evidence of increased parasympathetic tone in children with epileptic discharges during music exposure.

The beneficial effects of the music therapy on elderly patients with cerebrovascular disease and dementia has been studied by Okada et al [22] and they have reported that the music therapy enhanced parasympathetic activities and decreased the frequency of congestive heart failure in these patients, as evidenced by the reduced levels of plasma cytokine and catecholamine levels in their studies. A randomized crossover study done in mechanically ventilated patients at the intensive care

unit by Beaulie-Boire et al [23] have shown that there was a rapid reduction of blood cortisol after listening to music. Chen et al [24] also have reported that music therapy had decreased the anxiety level and systolic blood pressure in oncology patients, who received the music intervention prior to radiotherapy.

### Conclusion

Music therapy is a complementary and alternate medicine. In the present study, music therapy could reduce the stress levels in the medical students. Therefore, this study provides the preliminary evidence that listening to classical music could be an effective method of relaxation, as indicated by a shift of the autonomic balance towards the parasympathetic activity among medical students.

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