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A Cross Sectional Study on the Autonomic Modulations Produced By Music Listening In Anxious Medical Professionals.

R Sobana¹, K Jaiganesh^{1*}, V Kuzhandaivelu², and S Vadivel³.

¹Department of Physiology, Mahatma Gandhi Medical College & Research Institute, Pondicherry. 607 402.

²Department of Biochemistry, Mahatma Gandhi Medical College & Research Institute, Pondicherry. 607 402.

³Department of Physiology, Karpagavinayaga Institute of Medical Sciences & Research Centre, Madhuranthagam.603 308

ABSTRACT

The elevated anxiety level in professionals like medicos can be reduced by adopting relaxation techniques such as music listening. The impact produced by music is studied by Heart Rate Variability analysis (HRV). To expose anxious medical professionals to soothing music and assess changes produced on basal physiological parameters and HRV. Amongst the 50 medicos recruited for the study, 24 had elevated anxiety level (SAS Index>45). They were exposed to soothing music. Basal physiological and HRV parameters (Time domain, Frequency domain) of pre and post music session were recorded and analysed. Post music session recordings compared to premusic session show statistically significant decrease in Heart rate, Systolic Blood Pressure and increase in all Time Domain analysis variables and HF (High Frequency) ratio of Frequency Domain analysis variables.

Keywords: Anxious professionals, Music, HRV analysis.

**Corresponding author*

INTRODUCTION

Medical professionals experience greater stress due to high academic and work demands, long and odd working schedule, rigorous skill trainings and greater competency expected by superiors at workplace. Exposure to such chronic stress increases their sympathetic drive leading to autonomic imbalance, the prime predisposing factor of various psychosomatic illnesses [1]. Relaxation techniques can be adopted and followed by such professionals to reduce their stress level, improve health status and enhance performance. Music listening as a mode of relaxation technique has been documented by several music therapist and investigators based on various clinical trials [2]. Music can be offered in two forms, as described by Dileo viz, music therapy which is rendering tailored music by trained musicians and music medicine which is passive listening to pre-recorded music offered by medical professionals [3]. The anxiolytic effect produced by listening to music of slow tempo has been studied extensively by many investigators by assessing physiological parameters such as heart rate, blood pressure, respiratory rate and psychological parameters [4]. Establishment of autonomic stability which indicates stress reduction is evaluated by Heart Rate Variability (HRV) analysis. The Cochrane review of cardiology states that only few studies with lesser sample size and inconsistent data have been taken up so far on the effect of music on HRV [5]. So the present study is undertaken to explore the effects produced by music on stress, by HRV analysis in medical professionals with elevated anxiety level.

METHODOLOGY

Study undertaken was a cross sectional study conducted by the department of Physiology under the guidance of Music Therapy unit with the clearance from the Institutional Human Ethical Committee. Both male and female medical professionals with elevated stress level (as assessed by Zung self-rating anxiety scale [6] (SAS index above 45) between the age group of 24-55 years were included for this study with written informed consent. Subjects with hypertension, diabetes, hearing difficulties and those on antipsychotic medications were excluded.

Intervention

50 medical professionals were recruited for the study. Among them 24 were found to be having elevated anxiety level as assessed by Zung self-rating anxiety scale (SAS index above 45). Pre-recorded instrumental music in classical style, slow tempo, low pitch and regular rhythm was chosen, as recommended by the Music Therapy unit based on clinical trials conducted earlier [7]. Pre interventional basal physiological parameters, HRV recordings were done in the department research laboratory in a calm atmosphere with those having elevated anxiety level. Pre-recorded instrumental music in classical style, as recommended by the Music Therapy unit administered through headphone for a period of 20 minutes and post intervention recordings were also done in the same subjects.

HRV Measurements

Basal physiological parameters assessed were Heart rate, Systolic and Diastolic Blood pressure. The European Society of Cardiology has approved Heart Rate Variability (HRV is a

measurement of beat to beat difference in cardiac cycle length) as the major diagnostic tool to assess the autonomic fluctuations in healthy and diseased states [8]. In the present study Time domain, Frequency domain analysis was done using RR polyrite.

Time domain includes

- SDNN: Standard deviation of mean NN intervals.
- RMSSD: Square root of mean squared differences in successive NN intervals
- pNN50: The proportion derived by dividing NN50 by total number of NN intervals.

Frequency domain includes

- LF waves: Low frequency-0.04-0.15Hz: indicate sympathetic & parasympathetic activity.
- HF waves: High frequency 0.15-0.4Hz: indicate parasympathetic dominance.
- LF/HF ratio: indicate sympatho-vagal balance [9,10].

Statistical Analysis

The pre, post music session results were entered in excel sheet and analysed using SPSS software by Chi square test.

RESULTS

Analysis of results show, among the physiological parameters (Table.1 & Figure.1) heart rate, systolic blood pressure are reduced significantly in post session after music listening compared to the pre session (p=0.001)

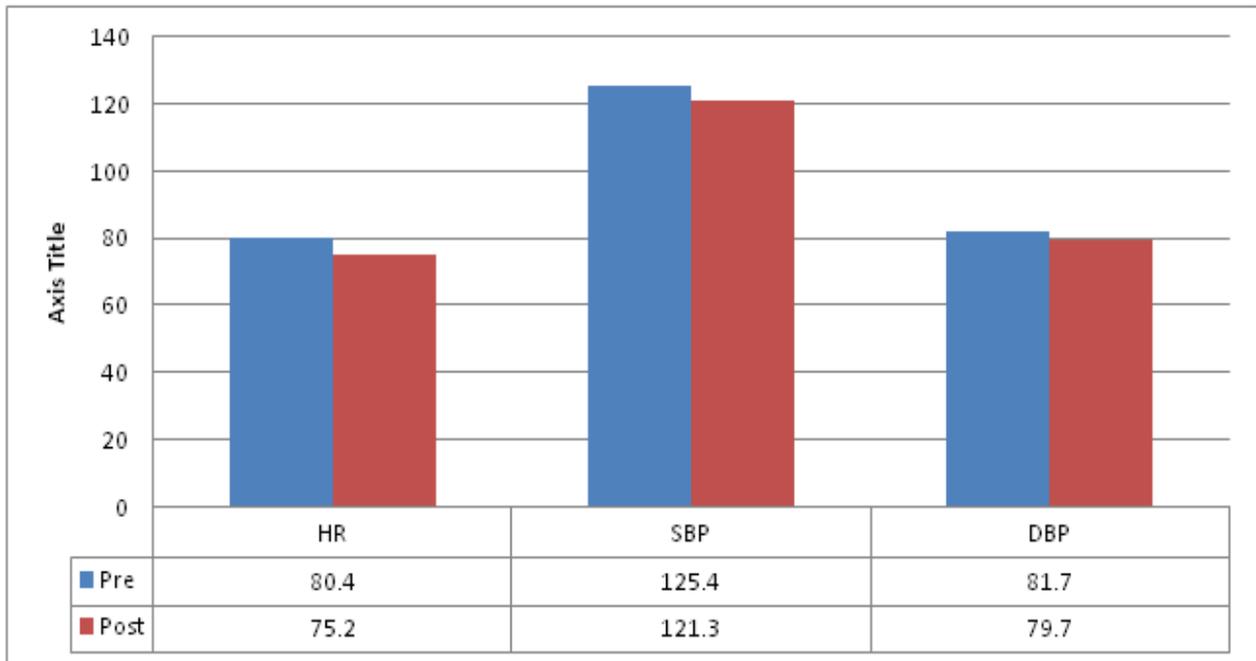
Table 1: Physiological Parameters

		Mean	SD	p Value
HR	Pre	80.40	6.33	0.001
	Post	75.20	6.16	
SBP	Pre	125.40	4.55	0.001
	Post	121.30	4.41	
DBP	Pre	81.70	4.32	0.001
	Post	79.70	4.37	

Table 2: Time Domain Analysis

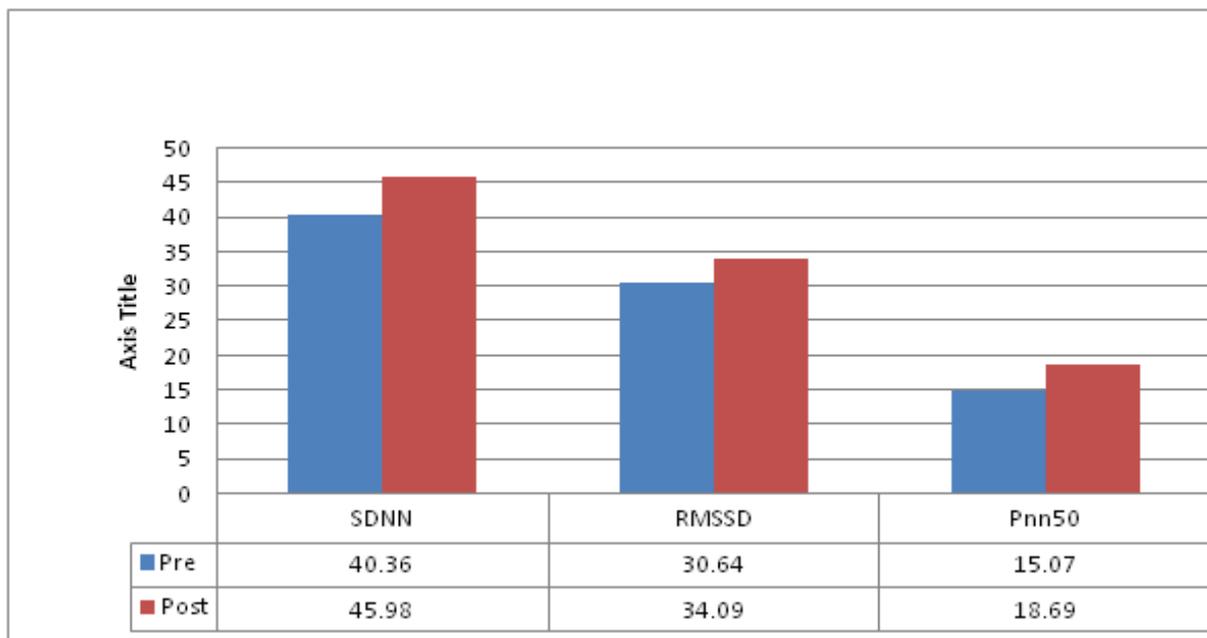
SDNN	Pre	40.30	13.95	0.010
	Post	45.99	16.58	
RMSSD	Pre	30.65	13.83	0.021
	Post	34.09	13.07	
Pnn50	Pre	15.07	15.14	0.125
	Post	18.70	15.66	

Figure 1: Physiological Parameters



HRV analysis of time domain (Table.2 & Figure.2) shows statistically significant change in SDNN ($p=0.01$) and RMSSD ($p=0.021$) in the post music session results, compared to pre-music session.

Figure 2: Time Domain Analysis

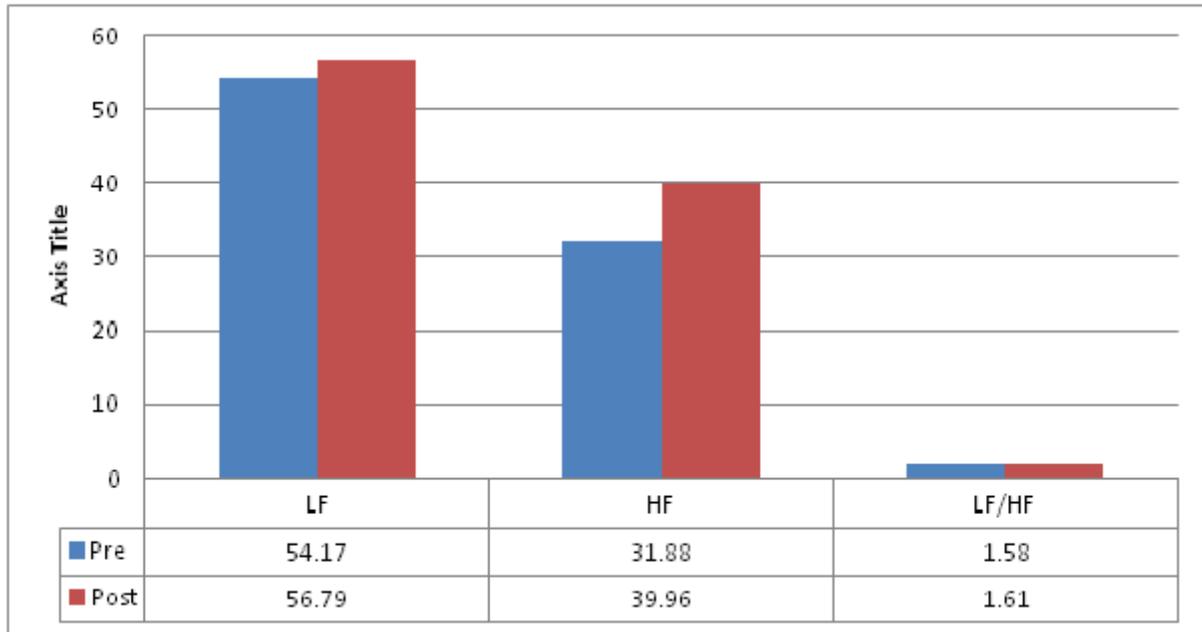


Frequency domain results (Table.3 & Figure.3) of our study shows insignificant alteration in LF, LF/HF and a statistically significant increase in HF ($p=0.012$) in the post music recording.

Table 3: Frequency Domain Analysis

LF	Pre	54.18	20.27	0.638
	Post	56.80	20.42	
HF	Pre	31.884	9.86	0.012
	Post	39.96	8.56	
LF/HF	Pre	1.58	1.06	0.912
	Post	1.62	0.96	

Figure 3: Frequency Domain Analysis



DISCUSSION

Reduction of the physiological parameters (Table.1) in post session after music listening compared to the pre session ($p=0.001$) indicate a definite cardiovascular effect produced by music as documented by previous reseachers [11,12].

HRV analysis of time domain (Table.2) shows statistically significant change in SDNN ($p=0.01$) and RMSSD ($p=0.021$) in the post music session results, compared to pre-music session recording concurrent with Gail et al [13] who studied acute impact of music in HRV. But Hyorim et al [14] concluded from this studies on meditating women that Time domain results are more specific for prolonged exposures.

Frequency domain results (Table.3) of our study shows statistically significant increase in HF ($p=0.012$) in the post music recording. Karou okada et al [15] studied the effect of music on elderly and arrived at similar frequency domain results, explains the increased HF ratio as an indicator of establishment of vagal tone by the soothing music. As LF, LF/HF ratio are determined by both sympathetic, parasympathetic components these values do not show much changes [16].

Analysis of the effects produced on the physiological, HRV parameters indicate a shift of the autonomic nervous system towards parasympathetic dominance [17]. It is a proven fact that reduction in sympathetic tone reduces anxiety and prevents its complications. The physiological molecular basis of the effect brought about by music can be explained by review of earlier studies undertaken by music therapist [18]. Auditory pathway is the most densely interconnected tract, with collaterals to the nuclei of Limbic system, Amygdala and Hippocampus which are the seat of emotions [19]. Hence the anxiolytic effect of music is by these neuronal connections modulating the Hypothalamus Pituitary axis thereby reducing the adrenaline surge leading to anxiety.

CONCLUSION

As our study confirms the anxiolytic effect of music, we can recommend that professionals with high job stress can adopt music listening as a mode of relaxation. Future studies can be taken up on the anxiolytic effect of music exposure for a prolonged period and music selected by the subjects own preferences.

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