

Short Communication

The Effects of Tempo of Music on Heart Rate, Blood Pressure and Respiratory Rate – A Study in Gauhati Medical College

Bonti Bora*, Manas Krishna and Kankana Dutta Phukan

Department of Physiology,
Gauhati Medical College,
Guwahati, Assam

Abstract

Previous studies have shown that different music based on a variation in the tempo or beats per minute can have different physiological effects on the body. Our study group included 70 asymptomatic individuals in age group 20 to 50 years with normal hearing, without special interest in one music genre. They were asked to listen to two different music with one being slow tempo of 50-60 beats per minute and the other having fast tempo music of 120 to 130 beats per minute for 10 minutes each. There was a significant increase in both the systolic ($p < 0.0001$) and diastolic ($p < 0.0001$) blood pressure of the subjects on listening to fast tempo music while there was a statistically significant decrease in the mean of both the systolic and diastolic blood pressures of the subjects on listening to slow music. Thus music may have a therapeutic use in persons suffering from anxiety and tension and may also have a positive effect on the physiological wellbeing of a person.

Introduction

Previous studies have shown that different music based on a variation in the tempo or beats per minute can have different physiological effects on the body. Music of fast tempo of 120–130 beats per minute have been found to simulate anxiety as evidenced from an increase in the blood pressure and heart rate while slow tempo music of 50–60 beats per minute have an opposite effect (1).

One study found that while listening to a Mozart sonata, participants' tension increased as tempo increased and decreased with moderate tempos (2). Music has also been found to have an effect on the intellectual and cognitive ability of individuals possibly through different interconnected processes in the brain.

Studies have suggested that music can have a number of effects on the physiology of an individual leading to some of the researchers advocating the use of music as a form of therapy.

A few studies found that patients suffering from anxiety, depression, pain, stress and insomnia benefit the most from listening to classical music as evidenced by a decrease in both heart rate and blood pressure. Some studies suggested that hip hop and

*Corresponding author :

Dr. Bonti Bora, Professor and Head of the Department of Physiology Department of Physiology, Gauhati Medical College, Guwahati, Email: Assam.borabonti.1@gmail.com

(Received on August 1, 2017)

rap music both having fast tempos, cause negative influences on patients by increasing their blood pressure and heart rate. In the study by Trappe et al it was reported that relaxing music significantly decreases the level of anxiety of patients in a pre operative setting to a greater extent than orally administered midazolam (3). Edworthy and Waring in their study, "*The effects of music tempo and loudness level on treadmill exercise.*" observed the effect of slow versus fast tempo music and found a significant difference between the heart rate of participants who exercised while listening to fast-loud music versus slow-quiet music (4). *Heart*, a *British Medical Journal* publication, reported that a study has shown that listening to music with a fast tempo increases blood pressure, whereas listening to slower tempo music has an opposite effect. People with musical training were found to be more inclined towards this change (5).

Bernardi L, Sleight P et al in their study have concluded that music induces an arousal effect, predominantly related to the tempo. Slow or meditative music can induce a relaxing effect (6).

Sakamoto in his research for the *Journal of Sound and Vibration* found that there was an increase in systolic and diastolic pressures during exposure to steady noise and music with high intensity peaks (7).

Samitha Siritunga et al in their study found that listening to Indian classical music for about 22 minutes significantly reduced systolic and diastolic blood pressure, pulse rate and respiratory rate of asymptomatic individuals and concluded that music may have a potential beneficial role in cardio vascular disease preventive programme (8).

In another study it was seen that physiological responses (heart rate, respiratory rate and blood pressure) were greater during excitative music than during sedative music. Music preferences did not however affect the physiological responses (9).

Agrawal et al in their study found that 93% of subjects

experienced a decrease in heart rate following a slow tempo song and 100% of subjects experienced an increase in heart rate following the fast tempo song (10).

The present study measures heart rate, blood pressure and respiratory rate in relation to slow tempo and fast tempo music. A positive correlation could provide the grounds for use of music therapy in patients who are suffering from anxiety or tension.

Objectives

Our study measures and attempts to find the effect of listening to fast tempo and slow tempo music on

- Heart rate, blood pressure and respiratory rate.

Materials and Methods

The study was carried out in Dept of Physiology, Gauhati Medical College, Guwahati.

Inclusion criteria

Healthy individuals in age group 20 to 50 years with normal hearing. (as confirmed by tuning fork tests) and who do not have any special interest in one genre of music.

Exclusion criteria

Symptomatic individuals, subjects outside the age group 20 to 50 years or with hearing difficulty or subjects who have any particular interest in one genre of music.

The study was performed in the Neurophysiology Laboratory in the Department of Physiology. The test was carried out in comfortable temperature, humidity and light, with the subjects supine and wearing headphones. They were asked to listen to two different music which were selected according to their beats per minute. One being slow tempo of 50-60 beats per minute and the other having fast tempo music of 120 to 130 beats per minute for a time period of 10 minutes each.

The heart rate and respiratory rate were measured using the Medicaid Student Physiograph. The subject's heart rate, blood pressure and respiratory rate were taken before and after each song. These parameters (heart rate, blood pressure and respiratory rate) were measured three times during the test. First at the start of the experiment without music after the subject has been seated comfortably with back supported and rested and then measured once each at the end of listening for 10 minutes to the two types of music. A resting period of 5 minutes was given between the two types of music. Slow music was played first followed by fast tempo music after 5 minutes. The heart rate was measured from R-R intervals from ECG (lead II). A 10 second recording was taken each time and mean value of the heart rate calculated. The blood pressure was measured by sphygmomanometer.

Statistical analysis

To determine the effects of music type on heart rate, blood pressure, and respiratory rate statistical analysis was done by ANOVA tests conducted using IBM SPSS VER 19.

Results

The study was conducted among 35 male and 35 female subjects ($n=70$). In Table I we see that the mean S.B.P. was 132.35 ± 18.410 after listening to fast tempo music compared to 118.81 ± 16.326 after listening to slow tempo music. The mean D.B.P. was 77.42 ± 7.5 after listening to fast tempo music, compared to 69.64 ± 7.2 after listening to slow tempo music. The heart rate and respiratory rate were also increased after listening to fast music compared to slow music

but was not found to be statistically significant.

Discussion

In the study we found that there was a significant increase in both the systolic and diastolic blood pressure of the subjects on listening to fast tempo music. There was an increase of 6.42 mmHg in the mean S.B.P. and an increase of 3.92 mmHg in the mean D.B.P. following listening to fast music. On listening to slow music there was a decrease of 7.12 mmHg in the mean S.B.P and 3.86 mmHg in the mean D.B.P. This was found to be statistically significant. There was a decrease in the mean of both the systolic and diastolic blood pressures of the subjects on listening to slow music which was found to be statistically significant. This may be due to modulation of the cardiac autonomic nervous system by stimulation in the form of auditory input (11). A study by Nakamura T. et al indicated that in rats, musical auditory stimulation influences the autonomic nervous system via the auditory pathway, the suprachiasmatic nucleus, and the histaminergic neurons as evidenced by a reduction in renal sympathetic nerve activity and blood pressure (12). It may also be due to endothelial dependent flow mediated vasodilatation which is mediated by the release of endorphins (13). The pulse pressure and the rate pressure product also showed a decrease on listening to slow music while there was an increase on listening to fast music though not significant statistically. The respiratory rate was found to increase on listening to slow music and decrease on listening to fast music. However the changes in the respiratory rate were not found to be statistically significant. There was a slight decrease in the heart rate on listening to slow tempo music

TABLE I: Mean and standard deviation of blood pressure, respiratory rate, and heart rate on listening to slow and fast tempo music showing statistically significant change in systolic and diastolic blood pressure.

| Parameter | Mean±Standard deviation in variable conditions | | | p-value |
|----------------------------------|--|------------------|------------------|----------|
| | Before test | After slow music | After fast music | |
| 1. Systolic B.P (in mmHg) | 125.93±17.51 | 118.81±16.32 | 132.35±18.41 | <0.0001* |
| 2. Diastolic B.P (in mmHg) | 73.5±8.6 | 69.64±7.2 | 77.42±7.5 | <0.0001* |
| 3. Respiratory rate (times/min.) | 13.01±2.31 | 13.38±2.28 | 12.97±1.97 | 0.4763 |
| 4. Heart rate (beats/min.) | 76.8±7.3 | 75.45±7.2 | 77.82±7.4 | 0.1589 |

and a slight increase in the heart rate of the subjects on listening to fast tempo music, which was however not found to be statistically significant. Slight discrepancies might have occurred due to the “practice effect” when interpreting the data. According to this effect the subject could possibly have known what to expect after completing the first trial and this would have affected their test parameters. There is thus need to continue the study with a larger sample size and build on the results obtained in the present study.

Conclusion

Music is a combination of lyrics, beat, tone, rhythm, density, loudness, and frequency. In our study we have found that while fast tempo music increases the systolic and diastolic blood pressure, slow tempo music does have a calming effect as evidenced by the significant decrease in systolic and diastolic blood pressure and also the heart rate and respiratory rate though not significantly.

References

1. Robyn Armon, Adam Fisher, Brittney Goldfarb, Caley Milton. Effects of music tempos on blood pressure, heart rate, and skin conductance after physical exertion, University of Wisconsin – Madison, Lab 601, Group 10. 2011.
2. Krumhansl, Carol L. Music: A link between cognition and emotion. *Curr Dir Psychol Sci* 2002; 11.2: 45–40.
3. Trappe, Hans J. Effects of music on cardiovascular system and cardiovascular health. *Heart and Education in Heart* Apr. 2011.
4. Edworthy J, Waring H. The effects of music tempo and loudness level on treadmill exercise. *Ergonomes* 2006 Dec 15; 49(15): 1597–1610.
5. Bernardi L, Sleight P, Bandinelli G, et al. Effect of rosary prayer and yoga mantras on autonomic cardiovascular rhythms: comparative study. *BMJ* 2001; 323: 1446–1449.
6. Bernardi L, Porta C, Sleight P. Cardiovascular, cerebrovascular and respiratory changes induced by different types of music in musicians and non-musicians: The importance of silence. *Heart* Decembere 30, 2005.
7. Sakamoto H. Psycho-circulatory responses caused by listening to music, and exposure to fluctuation of noise or steady noise. *J Sound Vib.* 5 September, 2002; V 250(1): p. 23–29.
8. Samitha Siritunga et al. Effect of music on blood pressure, pulse rate and respiratory rate of asymptomatic individuals: A randomized controlled trial. *Scientific Research – An Academic Publisher*, April 2013; Vol. 5 No. 4A.
9. Iwanaga, Makoto, Youko Moroki. Subjective and Physiological Response to Music stimuli Controlled Over Activity and Performance. *J Music Ther* 1999; 36.1: 26–38.
10. Ayush Agrawal, Neil Makhijani, Penny Valentini. The effect of music on heart rate. *JEI* April 25, 2013.
11. Hans-Joachim Trappe. Music and medicine: The effects of music on the human being. *Appl Cardiopulm Pathophysiol* 2012; 16: 133–142.
12. Nakamura T et al. Auditory stimulation affects renal sympathetic nerve activity and blood pressure in rats. *Neurosci Lett* 2007 Apr 12; 416(2): 107–112.
13. Miller M et al. Divergent effects of joyful and anxiety-provoking music on endothelial vasoreactivity. *Psychosom Med* 2010 May; 72(4): 354–6. doi: 10.1097/PSY.0b013e3181da7968. Epub 2010 Apr 5.