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Effect of Music Exposure on Parasympathetic Function Tests

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Abstract

Introduction: Music is one of a small set of human cultural universities, evoking wide range of emotions. From exhilaration to relaxation, joy to sadness, fear to comfort and even combinations of these. Very few studies were done to measure the effect of music on autonomic nervous system.

Objective: Present study was conducted to evaluate effects of music exposure on autonomic nervous system by conducting parasympathetic function tests.

Methods: The present study consisted 50 clinically healthy subjects of both sexes between 18 to 30 years of age. Two parasympathetic function tests i.e., Deep breathing test (DBT) and Lying to standing (30:15) ratio were included in the study. Both the tests were carried out before and after exposure to 30 minutes of self-chosen, soft music and analysed statistically by Paired T test.

Result: There was increase in deep breathing difference after music exposure and the difference was statistically significant whereas 30:15 ratio did not show much difference after music exposure and also, the difference was statistically not significant by paired T test.

Conclusion: Thus, we conclude that parasympathetic activity may increase after music exposure

Keywords: Parasympathetic function test, Music, Deep breathing test, Lying to standing ratio

Introduction

In the mid 1800's Florence Nightingale recognised the power of music in hospital wards to aid in the process of healing soldiers injured in Crimean war. Nightingale also noted the effects of different types of the music. [1]

Although music is predominantly utilized for religious, enjoyment or entertainment purposes, it is gradually emerging as a promising non-pharmacological intervention for improving health outcomes in both healthy and diseased populations, especially in those with cardiovascular diseases. However, music intervention has not been adequately explored as a cardiovascular therapeutic modality due to the lack of extensive studies with quality methodology.[2]

In their study Bradt J et al showed that music interventions may have beneficial effects on anxiety, pain, fatigue etc in people with cancer. Furthermore, music may have a small effect on heart rate, respiratory rate and blood pressure.[3]

Cardiovascular Autonomic reactivity refers to cardiovascular responses to potential stimuli, which are essentially reflexive in nature indicating cardiovascular tolerance and adaptation.[4] In most autonomic disorders, parasympathetic function is affected before sympathetic function, so Deep breathing test (DBT) provides a sensitive screening measure for parasympathetic dysfunction in many autonomic disorders i.e. the difference between maximum heart rate during inspiration & minimum heart rate during expiration averaged over 6 cycles. [5] Deep breathing difference (DBD) describes

magnitude of respiratory sinus arrhythmia (RSA). The respiratory mediated heart rate changes are small during quiet breathing; therefore, deep breathing test is more convenient to evaluate RSA magnitude.

On changing the posture from supine to standing, the heart rate increases immediately, usually by 10 to 20 beats per minute. On standing HR increases until it reaches maximum at about the 15th beat, after which it slows down to a stable state at about 30th beat. The ratio of R-R intervals corresponding to the 30:15 heart beat is called as 30:15 ratio which is the ratio of longest R-R interval around 30th beat divided by shortest R-R interval around 15th beat after standing. The 30:15 ratio is a measure of parasympathetic function.

The aim of present study was to assess parasympathetic nervous system activity before and after music exposure.

Materials And Methods

The present study was conducted in the Department of Physiology in our institute.

The subjects were asked to refrain from ingesting any beverages containing caffeine and alcohol for at least 12 hours prior to the study. They were asked to report between 10 a.m. to 12 p.m. in the lab after an adequate night's sleep followed by light breakfast. Written informed consent was taken before the clinical examination of the subject. The subject was allowed to relax on a bed in supine position for 10 minutes and then parasympathetic function tests were performed after initial 1-2 sessions of practice. Subjects were exposed to music with the help of headphones. Both the tests were carried out before and after exposure to 30 minutes of self-chosen, soft music.

Parasympathetic Function Tests:

Deep breathing test (DBT)

The subject was instructed to keep breathing smooth, slow & deep. First baseline ECG was recorded for 1 minute in supine position using "Physiopac" by "Medicaid". The subject was then given hand signal to maintain the rate & timing of the breathing. During DBT subject was asked to do maximal inspiration for 5 seconds and maximal expiration for 5 seconds for 6 cycles per minute. Difference between maximum heart rate during inspiration & minimum heart rate during expiration averaged over 6 cycles & Deep Breathing Difference (DBD) was calculated.

Lying to standing ratio (30:15)

The subject was instructed about the test. The test was conducted after 10 minutes of supine rest. Baseline ECG was recorded for 1 minute and then subject was asked to attain the standing posture within 3 seconds without any support. 30:15 ratio, which is the ratio of longest R-R interval around 30th beat divided by shortest R-R interval around 15th beat after standing was calculated.

The data was expressed in terms of mean and standard deviation and statistics was determined using Paired T test. P value <0.05 was considered to be statistically significant.

Results -

There was increase in deep breathing difference after music exposure and the difference was statistically significant (Table 1 & Figure 1) whereas 30:15 ratio did not show much difference after music exposure and also, the difference was statistically not significant by paired T test. (Table 2 & Figure 2)

Discussion -

In the present study there was an increase in deep breathing difference (24.68±5.04 vs 27.28±8.81) after music exposure during Deep breathing test. On the other hand, 30:15 ratio did not show much difference (1.33±0.24 vs 1.36±0.17) after music exposure on standing from lying down position. The deep breathing difference was statistically significant whereas that of 30:15 ratio was not by paired T test.

Thus, our study shows that parasympathetic activity increases after music exposure. Our study is in accordance with the study done by Jia T et al who suggested that music increased parasympathetic activity and attenuated the exercise-induced decrease in parasympathetic activity without altering the orthostatic tolerance after exercise. Therefore, music may be an effective approach for improving post-exercise parasympathetic reactivation, resulting in a faster recovery and a reduction in cardiac stress after exercise.[6]

It is also in accordance with the study done by White JM who showed that listening to music increases the parasympathetic activity.[7] On the other hand, da Silva AG et al observed that music with different

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tempos does not influence cardiac autonomic regulation in men.[8]

Previous study in patients with depressive symptoms shows that carefully selected music that incorporates a patient's own preferences may offer an effective method to reduce anxiety and to improve quality of life.[9] Also the most benefit on health is visible in classic music, meditation music whereas heavy metal music or technosounds are even ineffective or dangerous and will lead to stress and/or life-threatening arrhythmias.[9] Thus we have chosen self-selected, soft music in our study.

According to Lee et al, beneficial effect of music could be due to influence on the limbic system of brain, the centre of emotion, feeling and sensations, by reducing the ability to relay uncomfortable feelings. Also, it triggers the release of endorphins, the body's natural mood-altering substances which causes decrease in blood pressure and heart rate after listening to music in anxious subjects.[10] However, Gillen has suggested that more research is needed to examine the physiological mechanisms that explain the anxiolytic effects of music.[11]

Conclusion -

The present study shows that music exposure influences cardiac autonomic activity. It probably causes generalised increase in parasympathetic activity as seen by increase in the deep breathing difference on exposure to music.

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TABLES

Table 1: Comparison of Deep Breathing Difference of subjects before & after music exposure and Statistical analysis using paired T test

	Before Music	After Music	P value	Significance

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	Mean ± S.D.	Mean ± S.D.		
DBD (bpm)	24.68±5.04	27.28±8.81	<0.01	Statistically significant

1. (DBD – Deep breathing difference, bpm – Beats per minute)

Table no. 2 : Comparison of 30:15 ratio of subjects before & after music exposure and Statistical analysis using paired T test

	Before Music	After Music	P value	Significance
	Mean ± S.D.	Mean ± S.D.		
30:15 ratio	1.33±0.24	1.36±0.17	0.4	Not significant

Figures -

Figure 1: Comparison of Deep Breathing Difference (DBD) before and after music exposure

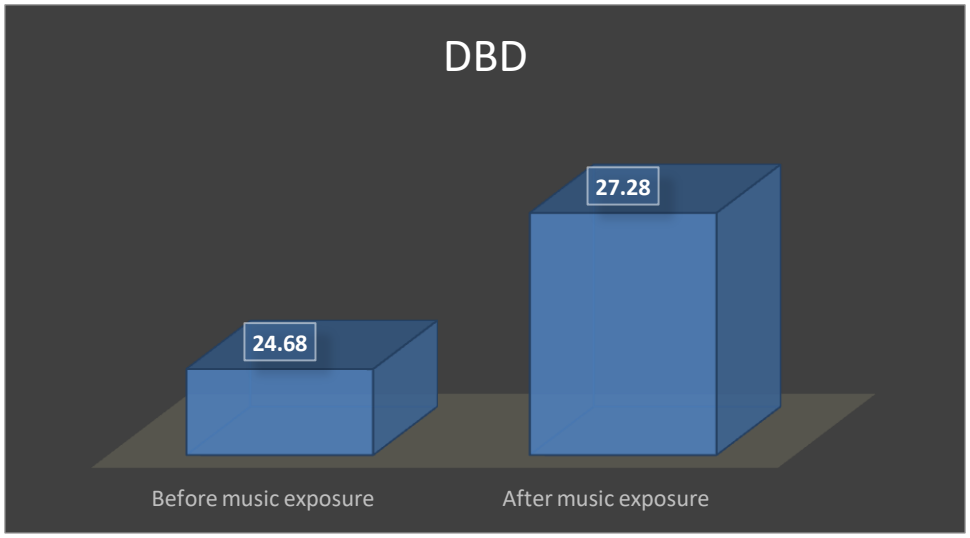
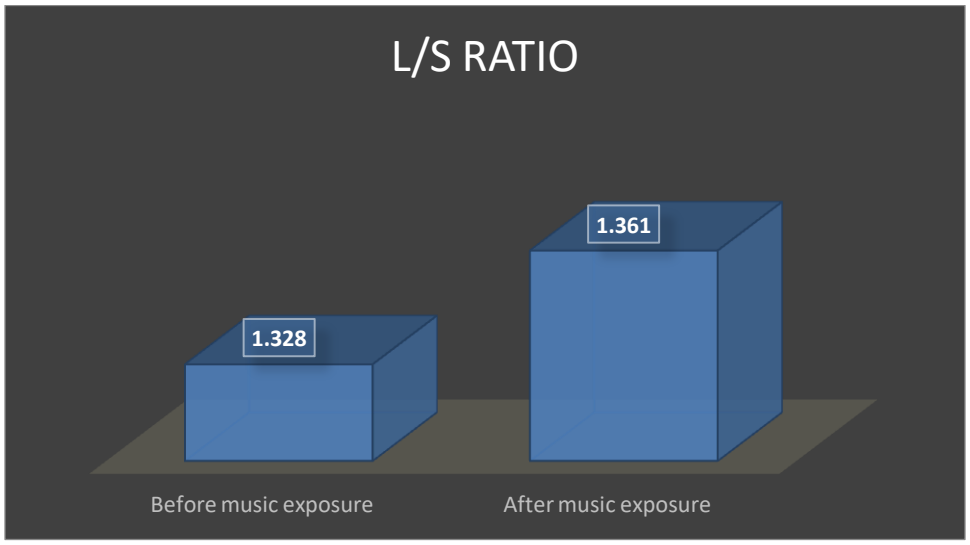


Figure 2: Comparison of 30:15 Ratio before and after music exposure



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