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**Original Research Article**

# The effects of music on pulse rate and blood pressure in healthy young adults

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## ABSTRACT

**Background:** Music is a combination of frequency, beat, density, tone, rhythm, repetition, loudness and lyrics. Cardiovascular autonomic function syncs with the different musical rhythms and modulates the cardiovascular system. When we are exposed to slow beat music the parasympathetic nervous system is stimulated decreasing the heart rate and while listening to fast beat music the sympathetic nervous system is stimulated and increases the heart rate. The purpose of the study was to evaluate the effects of slow and fast beat music on pulse rate and blood pressure.
**Methods:** We conducted a cross-sectional study in 100 healthy adults of age group 18-25yrs. The subject was made to lie down in a couch and pulse rate and blood pressure is measured by LED BP apparatus. After that slow beat music ("The weightless" most relaxing song of 2011) was played through the headphone. Then the pulse rate and blood pressure were recorded immediately after the music. After a period of 5 minutes rest, again pulse rate and blood pressure were measured. Then, fast beat music ("World Wide chopper") was played and the pulse rate and blood pressure were measured immediately after the fast music.
**Results:** There was significant reduction in pulse rate and blood pressure after listening to slow music whereas there was significant increase in pulse rate and blood pressure after listening to fast music.
**Conclusions:** We concluded that listening to slow beat music lowers the pulse rate and blood pressure, thereby improving the cardiac autonomic regulation.

**Keywords:** Blood pressure, Fast beat music, Pulse rate, Slow beat music

## INTRODUCTION

India is one of the most diverse countries in the world with languages, religions, dance, music, architecture, food and customs. In that, music plays an important role to improve the person's quality of life. Today it is common to find people listening to music during many days to day activities.

The reason for which they are listening to music and to what type of music varies with personal preference.[1] Generally when we are listening to fast beat music we get excited whereas slow beat music makes us relax.[2]

Several recent studies suggest that music as a form of treatment in the medical field. Music could serve as an effective stress management tool for certain diseases. The slow beat music has a relaxing effect.

So, it can be used as an adjuvant to reduce anxiety and stress in patients after surgery. Whereas the fast beat music found to enhance the performance of athletes, since it has an arousal effect.[3]

Music alters the mood and behaviour thereby induces changes in human emotions, so it is used as a therapeutic agent in the medical field. Music has been linked to the

treatment of mental illness, and has been successfully used to treat anxiety and depression.[2]

Does the heart respond to music? Yes. The heart pumps blood to different parts of the body at a rate which varies from person to person controlled by the autonomic nervous system.[3] Music listening modifies the cardiovascular autonomic function; the extent of modification varies with the individual.[4]

So, when we are exposed to slow beat music the parasympathetic nervous system is stimulated and thus the heart rate decreases and while listening to fast beat music the sympathetic nervous system is stimulated and increases the heart rate. The possible reason for this variation is that when we listen to music, our brain catches the rhythm and sends signals to different organs of the body, including the heart. Thus, the heart beats in response to the tempo of the music.[3]

So, the aim of this study is to evaluate the effects of slow beat and fast beat music on pulse rate and blood pressure in healthy young adults.

## METHODS

This was a cross-sectional study done in the Department of Physiology, Chengalpattu medical college, Tamil nadu. Approval from the institutional ethical committee was obtained. 100 healthy adults (50 males and 50 females) with the age group of 18-25years 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 clinical examination was done. The anthropometric parameters such as height, weight was measured, and BMI was calculated using Quetelet's formula.

### *Requirements*

The materials required for the study are stop watch, I-pod, Head phone, LED BP apparatus. The subjects listened to the songs using Sony Headphones. The volume of the music was kept constant throughout the experiment.

### *Procedure*

The procedure was explained and carried out as follows.

- The subject was made to lie down comfortably on a couch and allowed to take rest for a minute,
- Then the baseline pulse rate and blood pressure are measured by LED BP apparatus,
- The slow beat song ("The weightless" most relaxing song of 2011) was played through the headphone,
- Immediately after the music stops, the pulse rate and blood pressure were measured within an interval of 30seconds. Stop watch was used for timing,
- After a period of 5minutes rest, Pulse rate and blood pressure were measured again. Then, fast beat song ("World Wide chopper") was played. The pulse rate and BP are measured within an interval of 30seconds after the music stops.

### *Statistical analysis*

Statistical analysis was performed using SPSS version 19. The pulse rate and blood pressure recorded pre-exposure and post-exposure slow music and fast music were analyzed using Students Paired 't' test. P value of less than 0.05 was considered as significant.

## RESULTS

100 healthy young adults participated in the study. Out of this, 50 are male and 50 are female. The anthropometric and the cardiovascular parameters were analyzed by arithmetic mean and standard deviation using Independent Student's t test.

The biophysical profiles of the study group such as age, height, weight and BMI are presented as mean ± standard deviation in Table 1.

**Table 1: Biophysical profile of the study group.**

| Parameter | Mean ±SD |
|---|---|
| Age | 19.46±4.46 |
| Height (cm) | 164.02±9.86 |
| Weight(kg) | 58.31±10.53 |
| BMI (kg/m$^2$) | 22.05±3.63 |

Table 2 shows the comparison of pre- exposure and post-exposure effects of slow music on pulse rate, systolic blood pressure and diastolic blood pressure. The pulse rate (p =0.012), the SBP (p = 0.004), the DBP (p = 0.018) was found to be significantly reduced after listening to slow music.

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

| Parameters | Pre-exposure | Post-exposure | P value |
|---|---|---|---|
| Pulse rate (beats/min) | 75.90±10.92 | 71.20±10.28 | 0.012* |
| Systolic blood pressure (mmHg) | 111.05±11.91 | 104.95±11.20 | 0.004* |
| Diastolic blood pressure (mmHg) | 65.10 ± 7.77 | 61.93 ±6.80 | 0.018* |

(*P value less than 0.05 was considered to be statistically significant)

Table 3 shows the comparison of pre- exposure and post-exposure effects of fast music on pulse rate, systolic blood pressure and diastolic blood pressure. The pulse rate (p =0.012), the SBP (p = 0.004), the DBP (p = 0.018) was found to be significantly increased after listening to fast music.

**Table 3: Comparison of pulse rate and blood pressure between pre-exposure and post-exposure to fast music.**

| Parameters | Pre-exposure | Post-exposure | P value |
|---|---|---|---|
| Pulse rate (beats/min) | 76.79±10.63 | 81.61 ±10.04 | 0.02* |
| Systolic blood pressure(mmHg) | 107.62±11.77 | 112.59±10.05 | 0.01* |
| Diastolic blood pressure(mmHg) | 64.64 ±7.98 | 68.02 ± 7.97 | 0.02* |

(*P value less than 0.05 was considered to be statistically significant)

Table 4 shows that in males the mean values of pulse rate and diastolic blood pressure was decreased after listening to slow music but not statistically significant, whereas the systolic blood pressure was significantly reduced. Whereas in females, the mean values of pulse rate, both systolic and diastolic blood pressure was decreased after listening to slow music but not statistically significant.

Table 5 shows that in males the mean pulse rate was increased significantly after listening to fast beat music, whereas the systolic and diastolic blood pressure was increased but not statistically significant.

Whereas in females, after listening to fast beat music the mean values of pulse rate are increased but not statistically significant. But the mean values of systolic and diastolic blood pressure were significantly increased, and p value is less than 0.05.

**Table 4: Effect of pulse rate and blood pressure between pre-exposure and post-exposure to slow music among gender.**

| Parameter | Slow music | | | | | |
|---|---|---|---|---|---|---|
| | Male | | | Female | | |
| | Pre-exposure | Post exposure | P value | Pre-exposure | Post exposure | P value |
| Pulse rate | 76.74±11.65 | 71.48±9.45 | 0.055 | 75.03±10.24 | 70.9±9.9 | 0.12 |
| SBP (mmHg) | 114.76±11.63 | 106.51±10.95 | 0.005* | 107.26±11.28 | 103.33±11.40 | 0.18 |
| DBP (mmHg) | 65.09±7.50 | 62.0±6.92 | 0.096 | 65.1± 8.18 | 61.68± 6.78 | 0.10 |

(* P value less than 0.05 was considered to be statistically significant)

**Table: 5 Effect of pulse rate and blood pressure between pre-exposure and post-exposure to fast music among gender.**

| Parameter | Fast music | | | | | |
|---|---|---|---|---|---|---|
| | Male | | | Female | | |
| | Pre-exposure | Post exposure | P value | Pre-exposure | Post exposure | P value |
| Pulse rate | 78.48±10.49 | 83.80±9.89 | 0.04* | 75.03±10.65 | 79.33±9.8 | 0.11 |
| SBP (mmHg) | 112.45±10.62 | 116.13±9.11 | 0.14 | 102.63±10.9 | 108.93±9.8 | 0.02* |
| DBP (mmHg) | 65.09± 8.23 | 67.51±8.2 | 0.25 | 64.16±7.83 | 68.53±7.8 | 0.03* |

(* P value less than 0.05 was considered to be statistically significant)

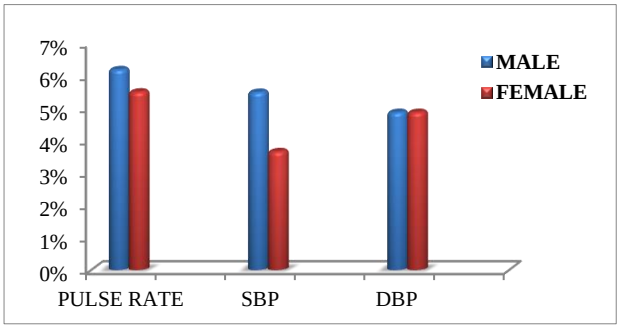


**Figure 1: Percent decrease in pulse rate and blood pressure by males and females after slow music.**

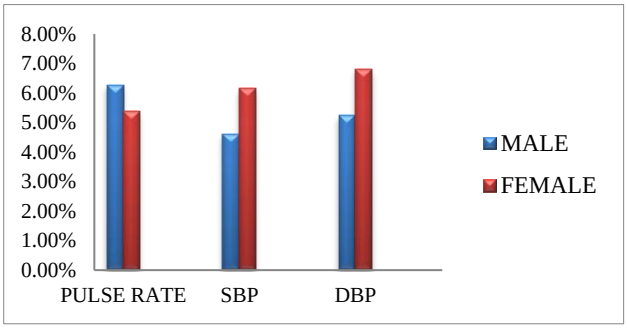


**Figure 2: Percent increase in pulse rate and blood pressure by males and females after fast music.**

Figure 1 shows the average percent decrease was slightly greater in male when compared to females after listening to slow beat music.

Figure 2 shows the average percent increase in pulse rate was slightly greater in male when compared to females after listening to fast beat music. Whereas, the average percent increase in systolic blood pressure and diastolic blood pressure was slightly greater in females when compared to males.

## DISCUSSION

Listening to music is a complex phenomenon and the response to music has a strong individual variability.[5] Music induced emotions are perceived by the listeners and its rhythmic aspects are one of the major determinants of physiological responses.[6]

### *Effect of slow music*

In our study, the mean (±SD) values of pulse rate, systolic blood pressure and diastolic blood pressure was significantly reduced when compared between the pre-exposure and post exposure to slow beat music.

These findings were consistent with the findings of Bernadi et al.[5] He stated that after listening to slow music there is decrease in heart rate but not a significant effect in blood pressure. According to Agrawal et al the song "Weightless" by the Marconi Union band begins with a beat of 60 beats per minute and then falls gradually to 50 beats/minute and found that the heart rate slowly comes down to match the beat.[3]

Similar results were also observed by Loomba et al.[7] According to them, slow music has a beneficial effect in pre-operative setting and ICU, because it is found to reduce the heart rate, SBP and DBP.

### *Effect of fast music*

According to Agrawal et al the song "World Wide choppers" is a fast pace rap song found to increase the heart rate. In the present study, there is significant increase in the mean values of pulse rate, SBP and DBP after exposure to fast beat music.[3]

These findings correlate with the Bernadi et al who observed that the fast beat music has an arousal effect which is proportional to the speed of music.[5] Thus musical rhythm synchronizes inherent cardiovascular rhythms and modulates the cardiovascular control. Similar results were observed by Robyn Armon et al and L Jaymie Thorne et al.[1,2]

Trappe states that fast music caused increase in blood pressure, heart rate and breathing rate, and reduced baroreflex sensitivity.[8] The mechanism how music listening modulates cardiac autonomic responses is unclear. One of those was the startle reflex response that is regulated by a brain stem circuit. This reflex induced by loud sounds causes a sudden rise in arterial blood pressure and heart rate. Whereas the slow music listening is involved in the release of dopamine in the mesolimbic reward system.[9]

Another explanation by Nakamura et al in 2007 is that the neural connection between the hypothalamic tuberomammillary nucleus and the suprachiasmatic nucleus could be part of the neural pathway between auditory stimulation with musical auditory stimulation and changes in cardiac autonomic regulation.[10]

### *Gender differences in the effect of music*

In our study the mean values of pulse rate and diastolic blood pressure of male subjects was decreased after listening to slow music but not statistically significant, whereas the systolic blood pressure was significantly reduced. Whereas in females, the mean values of pulse rate, SBP and DBP was found to be reduced but not statistically significant.

The possible explanation is that slow beat music may produce a soothing effect because the elevated body rhythm entrains with a slower and more natural homeostatic rhythm produced by the musical composition. Entrainment is perhaps facilitated if the music's marked pulse is close to an individual's natural heart rate and respiration. It has also been reported that changes in the heart rate are directly related to tempo of the music.[11]

Latha et al states that the normally men are susceptible to cardiac condition due to vagal inhibition and sympathetic activation. In our study, the percent decreases in pulse rate and blood pressure was slightly greater in males when compared to females and this suggest slow music listening has a shift toward vagal activity and is more pronounced in male.[12]

In male subjects, the mean pulse rate was increased significantly after listening to fast beat music, whereas the systolic and diastolic blood pressure was increased but not statistically significant. Similarly, in females the pulse rate is increased but not statistically significant, whereas the SBP and DBP were significantly increased.

The percent increase in blood pressure was greater in females when compared to males. Women are more sensitive to fast music than men and our study demonstrate that the effect of fast music are more intense in females and it is similar to the results observed by Gupta et al.[11] He observed that music heightened effects on BP, HR, stress, anxiety and depression in females, compared to males. Similar results were observed by Roque et al and states that women showed intense increase in sympathetic response to heavy metal music.[14] It is an established fact that physical, intellectual,

emotional or behavioural response of men and women to a given task or situation is different. This is due to the hormonal differences which in turn are due to the sex specific genotype expressions.[15]

## CONCLUSION

Listening to slow beat music can benefit the health of an individual by modulating the cardiovascular rhythms whereas fast beat music is ineffective and often dangerous. Thus, listening to slow beat music not only makes us happy but also has significant effect on cardiovascular system. So, it could have a potential use in managing patients with cardiovascular disease. It can also be utilized in depressive syndromes, psychiatric diseases and in intensive care medicine. Thus, music has a beneficial impact on health and well-being.

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