# International Journal of Physiology, Nutrition and Physical Education

**Manibalan Vijayaraman**
Assistant Professor, Department of Physiology, Vinayaka Missions Medical College and Hospital, Karaikal, Puducherry, India

**R Mukilan Ramadoss**
Assistant Professor, Department of Physiology CSI College of Dental Science and Research, Madurai, Tamil Nadu, India

# A study on effect of repeated favorite slow tempo songs on heart rate and systolic BP of young adults

## Manibalan Vijayaraman and R Mukilan Ramadoss

**Abstract**
**Introduction and Aim:** There are various preventive programmes being conducted to minimise the development of Cardio vascular diseases (CVD) based on modification in life style. Approaches targeted at reducing stress and anxiety such as music therapy, muscle relaxation therapy, meditation, biofeedback etc. are now being seriously considered. This study aimed to determine the effect of repeated favorite song on heart rate, pulse rate and BP before and after exercise in healthy adult persons.
**Materials and Methods:** This was a cross sectional observational study conducted in the department of physiology. A total of 80 participants whose age ranged between 19-22 years with normal body mass index, non-alcoholics, non-smokers and without any auditory defects were included in the study. Initially baseline blood pressure (BP) and HR of each subject were measured using sphygmomanometer, ECG in normal room temperature without any stimulus (day 1). Then before and after exercise, the subjects were exposed to slow-beat music (70-80beatspermints) for 3to 4 mints later HR, PR, Systolic BP was measured (day 2). Moderate exercise using Bi-cycle Ergometer for 5 mints (distance covered / Unit time is constant) after very small break (2-3 mints) subjects were exposed to slow beat music.
**Results:** This study showed that before and after exercise, exposed to repeated favorite slow tempo songs obtained significant ($P<0.001$) decreased HR, PR and systolic BP compared to baseline, or no song or single exposure of favorite song.
**Conclusion:** The study concluded that repeated slow tempo song has the considerable link with cardiovascular system and it has greater relaxation effect.

**Keywords:** Slow tempo, favorite song, heart rate systolic bp

## Introduction

Cardiovascular diseases (CVDs) have now become the leading cause of mortality in India. A quarter of all mortality is attributable to CVD. Ischemic heart disease and stroke are the predominant causes and are responsible for >80% of CVD deaths [1]. There are various preventive programmes being conducted to minimise the development of CVD based on modification in life style. Approaches targeted at reducing stress and anxiety such as music therapy, muscle relaxation therapy, meditation, biofeedback etc. are now being seriously considered [2].

In last decades, a growing body of evidence in the use of musical intervention in clinical setting have been seen, concerning singing, music listening, musical improvisation, and other musical activities, as long as more structured music therapy (MT) treatments [3]. 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 perminute have an opposite effect [4].

Parasympathetic nervous system is stimulated to slow beat music and thus the heart rate decreases. sympathetic nervous system is stimulated while listening to fast beat music and increases the heart rate. This variation could be due to, our brain catches the rhythm and sends signals to different organs of the body, including the heart while listing music. Thus, the heart beats in response to the tempo of the music [5].

Previous studies reported the effect of different tempo music on cardio vascular functions by subjecting participant to listen music for single time and the result are inconsistence [6, 7].

To the best of our knowledge no study has been reported the effect of repeated favorite song

**Correspondence**
**R Mukilan Ramadoss**
Assistant Professor, Department of Physiology CSI College of Dental Science and Research, Madurai, Tamil Nadu, India

on heart rate, pulse rate and BP. Hence we aimed to determine the effect of repeated favorite song on heart rate, pulse rate and BP before and after exercise in healthy adult persons.

**Materials and Methods**

This was a cross sectional observational study conducted in the department of physiology. The study protocol was approved by VMMC&H Scientific Steering Committee and Ethical Review Committee (ERC). All ethical issues were adhered to in all the stages of the protocol implementation. A total of 80 participants whose age ranged between 19-22 years with normal body mass index, non-alcoholics, non-smokers and without any auditory defects were included in the study. Participants who had any metabolic or infectious disorders were excluded from the study. Each participant read the information sheet provided regarding study and written informed consent was obtained.

Song selection was done prior to the experimental session. Participants were asked to self –report a title of their most favorite song. Orally confirmed, merely that it was their favorite song based in this: Participants provided the title of their favorite song to the experimenter prior to use it for the experiment. Slow beat song was analyzed 70-80 per beat min (BPM) by piston soft BPM detector (free in online).

Initially baseline blood pressure (BP), pulse rate and HR of each participant was measured in normal room temperature, without any stimulus (no song played –day 1). Then participants were exposed to slow beat song for 3-4 mints later their HR, pulse rate and BP were measured (day2).

Similarly, day 3 and day 4. The songs were delivered through the head phone and sound intensity was adjusted according to the subject's tolerance. The digital Sphygmomanometer was used to measure BP, PR and for HR computerized electrocardiogram (ECG) was used.

HR measurement: Computerized ECG recorder (CARDIOART 8408 VIVE, India) was used. Based on experimental procedure each group participants were allowed to continuous ECG record for 4-5 mints. Automatically, it shows the mean HR/min.

Moderate exercise: After baseline measurement participants were asked to do moderate exercise using Bi-cycle ergo meter (INCO, India) for 5mints (distance covered / unit time is constant) after that very small break 2-3 mints rest and the participants HR,PR and BP were measured (no song played day-1).Next day (day-2),after small break 2-3 mints rest, subjects were exposed to slow-beat (70-80 beats per mints) songs for 3-4 mints after that HR,PR and Systolic BP were measured, Similarly 3rd and 4th day song played and the measurements were done.

Statistical Analysis: Comparison between groups were analyzed by one way ANOVA followed by Turchy post test.

**Results**

A total of 80 participants were included in the study. All participants were divided randomly into two groups (40-control group and 40 exercise group). Heart function was evaluated after recording HR, PR and Systolic BP.

**Table 1:** Effect of repeated slow tempo songs on normal condition. Mean and standard deviation of HR, PR and Systolic BP.

|  | Day 1 Mean±SD | Day 2 Mean±SD | Day 3 Mean±SD | Day 4 Mean±SD |
|---|---|---|---|---|
| Heart rate | 77.40±5.518 | 77.25±5.541 | 76.93±5.460 | 70.70±4.040 |
| Pulse rate | 69.50±2.552 | 68.98±2.675 | 68.30±2.866 | 66.18±3.161 |
| Systolic BP | 115.0±9.124 | 115.6±16.01 | 113.7±15.97 | 104.6± |

**Note:** Normal healthy participants (N40), Day 1: No song plated, Day 2: favorite slow beat song played, Day 3 and Day 4: same song played.

**Table 2:** Effect of repeated slow tempo songs on normal condition, multiple comparison between day1-4 HR, PR and Systolic BP.

| Multiple comparison | Heart rate | | Pulse Rate | | Systolic BP | |
|---|---|---|---|---|---|---|
|  | Mean diff | P Value | Mean diff | P Value | Mean diff | P Value |
| Day1 vs Day2 | 0.1500 | P>0.05 | 0.5250 | P>0.05 | 0.575 | P>0.05 |
| Day1 vs Day3 | 0.4750 | P>0.05 | 1.200 | P>0.05 | 1.375 | P>0.05 |
| Day1 vs Day4 | 6.700 | P<0.001 | 3.325 | P<0.001 | 10.43 | P<0.001 |
| Day2 vs Day3 | 0.3250 | P>0.05 | 0.6750 | P>0.05 | 1.950 | P>0.05 |
| Day2 vs Day4 | 6.550 | P<0.001 | 2.800 | P<0.001 | 11.00 | P<0.001 |
| Day3 vs Day4 | 6.225 | P<0.001 | 2.125 | P<0.001 | 9.05 | P<0.001 |

**Note:** Normal healthy participants (N40), Day 1: No song played Day 2: Favorite slow tempo song played, Day 3 and Day 4 same song played. see Day 1 and 2Vs Day 4 showing significant <0.001 different, compare to other day.

**Table 3:** Effect of repeated slow tempo songs after exercise Mean and standard deviation of HR, PR and systolic BP.

|  | Day 1 Mean±SD | Day 2 Mean±SD | Day 3 Mean±SD | Day 4 Mean±SD |
|---|---|---|---|---|
| Heart rate | 105.0±10.82 | 104.1±10.66 | 102.7±9.962 | 76.03±6.471 |
| Pulse rate | 70.95±5.129 | 69.18±5.272 | 68.18±5.272 | 67.05±4.326 |
| Systolic BP | 125.5±6.843 | 124.3±6.532 | 122.7±5.709 | 105.0±7.271 |

**Note:** Normal healthy participants (N40) after exercise, Day 1: No song played, Day 2: Favorite slow beat song played, day 3 and day 4: same song played. SD – standard deviation.

**Table 4:** Effect of repeated slow tempo songs on exercise multiple comparison between day 1-4 HR, PR and Systolic BP.

| Multiple comparison | Heart rate | | Pulse Rate | | Systolic BP | | |
|---|---|---|---|---|---|---|---|
|  | Mean diff | P Value | Mean diff | P Value | Mean diff | q | P Value |
| Day1 vs Day2 | 0.8750 | P>0.05 | 1.850 | P>0.05 | 1.148 | 1.148 | P>0.05 |
| Day1 vs Day3 | 2.275 | P>0.05 | 2.775 | P>0.05 | 2.702 | 2.702 | P>0.05 |
| Day1 vs Day4 | 28.93 | P<0.001 | 3.900 | P<0.001 | 19.58 | 19.58 | P<0.001 |
| Day2 vs Day3 | 1.400 | P>0.05 | 0.9250 | P>0.05 | 1.554 | 1.554 | P>0.05 |
| Day2 vs Day4 | 28.05 | P<0.001 | 2.050 | P<0.001 | 18.43 | 18.43 | P<0.001 |
| Day3 vs Day4 | 26.65 | P<0.001 | 1.125 | P<0.001 | 16.88 | 16.88 | P<0.001 |

**Note:** Normal healthy participants (N40), Day1: No song played, Day 2: Favorite slow tempo song played, Day3 and 4: same song played. See 1st and 2 day Vs day 4 showing significant <0.001 difference, compare to other days.

## Discussion

The Present study aimed to investigate the effects of repeated favorite slow tempo songs stimulation on HR and systolic BP in healthy subjects. The results showed that repeated slow tempo songs less than 70-80 beats per mints significantly decreases the HR, systolic BP and pulse rate when compared to no song or first time exposed in both cases before and after exercise.

In both groups (normal and excersise) no significant difference was observred between day 1- day 2 and day 2-day 3(P>0.05). But highly significant difference was observed between day 1-day 4 and day 3 – day 4 ($P<0.001$). Similarly, study conducted by Bonti et al, 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. This study observed difference between fast and slow tempo songs [8].

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. [9] Research has shown that relatively small decreases, as low as 5 mmHg reduction in systolic blood pressure, would result in 7 % reduction in all-cause mortality, 9 % reduction in coronary heart disease related mortality and 14 % reduction in stroke-related mortality [10].

Reduction in blood pressure could be due to 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. It has also been reported that changes in the heart rate are directly related to tempo of the music [11]. Research in hypertensive animal models found music containing high-frequency sounds to stimulate dopamine synthesis leading to blood pressure reduction [12].

Our study results are not in agreement with the study conducted by Yamamoto et al. [7] As per Yamamoto et al, listening to slow rhythm music decreases the plasma norepinephrine level, and listening to fast rhythm music increases the plasma epinephrine level. The type of music has no impact on power output during exercise.

Most of the previous showed single exposure music effect on HR and BP but our present study clearly indicating that repeated exposure of favorite slow tempo songs has more potent effect compare to single exposure. It indicates repeated exposure of favorite slow tempo songs affecting the sympathetic and parasympathetic components of HRV [13].

Further, when a favorite song repeatedly exposed to a subject it may enhance the brain's synaptic communication easier, which is accepted to increase the synaptic plasticity [14]. Various mechanisms that cooperate to achieve synaptic plasticity, such as quantity of neurotransmitters released into a synapse and effectively cells respond to those neurotransmitters [15]. through which tonic inhibitory control peripherally via the vagus that may reduce the HR. In addition, hearing favorite music may enhance release of endorphin, a neuro-peptide in the brain, which may influence vascular activity which in turn causes decrease in systolic BP [16].

## Conclusion

The study concluded that songs has post exercise recovery and repeated slow music has greater relaxation effect that fast or no music or first time exposure, recovery time being independent of the gender and individual song preference. Further, this study indicate repeated slow tempo songs is an independent prognostic marker for reduce HR and BP. Each individual need specific rhythm, tone and pitch of song to raise the soul, one would then be able to heal him with the specific songs.

## References

1. Srinath Reddy K, Shah B, Varghese C, Ramadoss A. Responding to the threat of chronic diseases in India. Lancet. 2005; 366:1744-1749.
2. White J. Effects of relaxing music on cardiac autonomic balance and anxiety after acute myocardial in-farction. American Journal of Critical Care. 1999; 8:220-230.
3. Chanda ML, Levitin DJ. The neurochemistry of music. Trends Cogn Sci. 2013; 17:179-193.
4. Edworthy. Judy and Waring, Hannah. The effects of music tempo and loudness level on treadmill exercise. Ergonomics. 2006; 49(15):1597-1610.
5. Agrawal A, Makhijani N, Valentini P. The effect of music on heart rate. J Emerg Investig. 2013; 25:1-5.
6. Allen K, Blascoich J. Effects of music on cardiovascular reactivity among surgeons. Journal of the American Medical Association. 1994; 272:882-884.
7. Yamamoto T, Ohkuwa T, Itoh H, Kitoh M, Terasawa J, Tsuda T et al. Effect of pre-exercise listening to slow and fast rhythm music on supramaximal cycle performance and selected metabolic variables. Arch Physiol Biochem. 2003; 111:211-4.
8. Bonti Bora, Manas Krishna, Kankana Dutta Phukan. The Effects of Tempo of Music on Heart Rate, Blood Pressure and Respiratory Rate – A Study in Gauhati Medical College. Indian J Physiol Pharmacol. 2017; 61(4):445-448.
9. Agrawal A, Makhijani N, Valentini P. The effect of music on heart rate. J Emerg Investig. 2013; 25:1-5.
10. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo Jr JL et al. The seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. JAMA. 2003; 289(19):2560-72.
11. Suguna S, Deepika K. The effects of music on pulse rate and blood pressure in healthy young adults. Int J Res Med Sci. 2017; 5:5268-72.
12. Nilsson U. The anxiety- and pain-reducing effects of music interventions: a systematic review. AORN J. 2008; 87(4):780-807.
13. Levy MN. Sympathetic- Parasympathetic interaction in the heart. Circ Res. 1971; 29 (5):437-45.
14. Herholz SC, Zatorre RJ. Musical training as a framework for brain plasticity: behavior, function and structure. Neuron. 2012; 76:486-502.
15. Lappe C, Herholz SC, Trainor LJ, Pantev C. Cortical Plasticity induced by short-term unimodal and multimodal musical training. The Journal of Neuroscience. 2008; 28(39):9632-9.
16. Trappe HJ, Voit G. The Cardiovascular Effect of Musical Genres. Dtsch Arztebl Int. 2016; 113(20):347-52.