

ORIGINAL ARTICLE

Effect of Auditory Stimulation by Upbeat Music on Radial Pulse

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ABSTRACT

Introduction: Music of varying tempo or beats have physiological as well as adverse effects on the body. This study throws light on the influence of upbeat music on properties of radial pulse, in healthy young adults. **Methods:** One hundred and seventy-five students between the age of nineteen and twenty-four years were included in this study. The experiment was conducted in a room, devoid of any external disturbances. Subjects were made to listen the chosen upbeat music for 4 minutes using a headphone. The radial pulse was measured before and immediately after the experiment. Data analysis was done by using SPSS software version 16.0. **Results:** In this study we observed that normal mean pulse rate was 76 per minute in males and 72 per minute in female young adults. Following the auditory stimulation with upbeat music, rise in pulse rate was observed in more than 70% of subjects. Whilst, 24% showed a decrease pulse rate and 5% showed no change in pulse rate. Increased pulse rate was associated with decrease in amplitude of pulse wave but no change in rhythm and character of the pulse when compared to resting state. **Conclusion:** This study indicates that the music can increase the pulse rate in the majority of the subjects but also decreases the pulse rate in few individuals. This study provides the preliminary evidence to promote the music therapy in many preventive programs for patients with depression, patients with depressed cardiac functioning and useful in improving daily performances.

Malaysian Journal of Medicine and Health Sciences (2022) 18(5): 35-40. doi:10.47836/mjmhs18.5.6

Keywords: Auditory stimulation, Cardiac function, Pulse rate, Upbeat music

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INTRODUCTION

Music of varying tempo or beats brings various physiological effects on the body by influencing the autonomic system of the body (1). Recent advancement in the field of medicine has promoted various newer adaptation in therapeutics such as massage therapies (2), yoga (3), natural herbal therapies (4) and the music therapy (5). These alternative therapies found their beneficial effect in chronic ailments (6) and also in palliative care patients (7), in pediatric patients in hematology or oncology wards (8) and in ICUs (9).

Music therapy has shown its effectiveness in depressive or anxious individuals (10), athletes, neurological abnormalities such as autism, children or adult who are bed-bound. Athletes or individuals who are involved in sports activities try to find different ways to improve their performances. Doing exercise along with listening

to music has proved to enhance arousal, enables task-relevant imagery and improves simple motoric activities (11).

Music has been shown to improve learning skills, problem-solving skills (12) cognitive ability and improvement in academic performances (13), changes in human emotional status (14). Fast tempo music of 120-130 beats per minute has been shown to increase anxiety, happiness, rise in blood pressure and rise in heartbeat (15) whereas slow tempo music with 50-60 beats per minute is shown to cause the opposite effect (16). Music therapy has gained importance and found beneficial in relieving various ailments.

The studies have shown that listening to music while exercising had stimulated psychological benefits such as motivation and minimized distractions and improved the performance during exercise (5,11).

Listening to music had shown many therapeutic benefits in the medical field (17). The influence of music on cardiovascular functions such as heart rate, blood pressure (18) and neurological functions has been

studied (19). Music is an important aspect of the human species and all the cultures from oldest to modern make music (20). Studies indicate that the minor tones rise the pulse rate and lower the blood pressure, while the stirring music has shown augmentation in both (21,22). Studies demonstrated a rise in heart rate after listening to faster rhythm music like rap music and it has not shown any relaxing effect (23).

Studies shows that heart rate along with blood pressure has increased while subjects listened to music with a faster, irregular tempo (24). Studies demonstrated a beneficial effect of pleasant music on the heart (25) in patients with coronary vascular diseases where it has been shown to reduce depression, anxiety by activating the mesolimbic dopaminergic pathway (26), reduces pain and improves sleep by activating opioid and oxytocin mechanism (27) and relaxing music has decreased the blood pressure in hypertensive patients (28). Reports indicate that listening to music that substitutes a fast tempo with slower passages or pauses, help in bringing relaxation (29). Therefore, music can also be used as a supplementary meditation in the management of cardiovascular problems (25).

The rate of the pulse indicates the number of times the heart beats per minute. During this process, heart pumps the blood through the arteries that result in expansion and contraction of the wall of the arteries called a pulse. By palpating this pulse wave, we get an idea of the peripheral circulation, number of heart beats, heart rhythm, strength of the pulse or the volume as well as the condition of the wall of the blood vessel (30). Studying radial pulse following listening to upbeat music gives an idea about the influence of upbeat music on the autonomic system thereby its effect on heart hemodynamics and mental state of the subject. The estimation of a radial pulse is the easiest way to investigate cardiovascular activity. As per our knowledge, there are no studies that elucidate the effect of upbeat music that involves fast-paced rhythm and tempo, on the properties of radial pulse in young individuals. We hypothesize that upbeat music has a stimulatory influence on the heart. Hence this study has been undertaken to analyze the influence of upbeat music on properties of radial pulse in both male and female young adults.

MATERIALS AND METHODS

Participants for the study

This is a pilot study undertaken by medical undergraduate students of Melaka Manipal Medical College, MAHE, Manipal. A total number of 175 MBBS healthy students aged between 19-24 years were involved in this study, out of which 88 were females and 85 were male students.

Ethical approval

The letter of approval has been obtained by Institutional Research Committee [IRC], Melaka Manipal Medical

College, MAHE, Manipal India, IRC / MMMC / 2015, No.15. Informed consent was taken from all the participants who volunteered for this study. The study methodology was clearly explained to participants before collecting the consent form. The study has been conducted after obtaining IRC approval and informed consent was taken from each of the participants involved in the study.

Inclusion and exclusion criteria

Students having a history of any health issues like headache, psychological disturbances and the students who are regularly listening to upbeat music and are obese were excluded from the study. Students with normal blood pressure, and pulse rate average body weight were included in the study.

Study material

The study material used was upbeat music, David Guetta ft Sia – Titanium. Radial pulse tracing and data collecting was done using PowerLab, Lab tutor software-AD Instruments, model-ML4818, series: T15-1857

Experimental procedure or intervention

Before starting the intervention, all the students were made to sit in a soundproof room and an overview of the study such as the objectives of the study, duration of the experiment and how the experiment is conducted was explained by one of the investigators. The intervention was done only after taking informed consent from the subjects. Subjects were placed in a room that is devoid of external disturbances. Each subject was given five minutes to rest while listening to the procedure of the experiment by one of the investigators. After 5 minutes, the subject's radial pulse at rest was recorded. Subjects were allowed to listen to the upbeat song by using a headphone for 4 minutes. Immediately after the song has stopped, the subject's radial pulse was recorded.

Parameters studied

Properties of the radial pulse such as rate, rhythm, volume, the character were studied.

Statistical analysis

Data obtained are analyzed using SPSS software, version 16.0. The categorical variables were described as mean, median and maximum, minimum. Paired t-test was used to analyze the changes in the rate of the pulse before and after auditory stimulation with music in both the groups (male and female), $p < 0.05$ was statistically significant. A regression graph is plotted to evaluate the correlation between pulse rate and upbeat music.

RESULTS

The present study shows the effect of auditory stimulation by upbeat music on the radial pulse properties of young adults. Results of the study shows the variation in properties of the pulse after listening to upbeat music.

Out of a total number of students, an increase in pulse rate was observed in 71% of the male students and 67% of female students aged between nineteen to twenty-four years. At the same time decrease in pulse rate was observed in 23% males and 26% females of same age group. Whereas 3% males and 7% female students have shown no change in the pulse rate (Fig. 1). These observations show the varied response in pulse rate in males as well as in female students after listening to upbeat music.

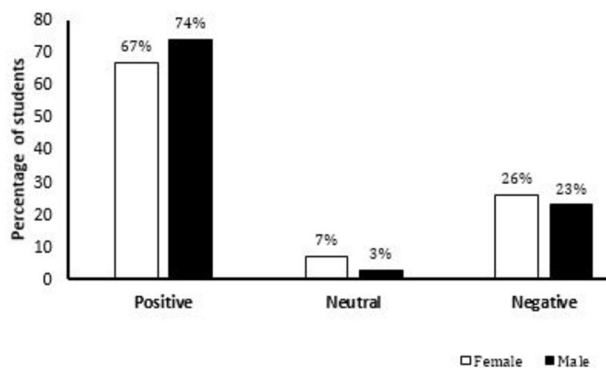


Figure 1: Percentage of radial pulse rate in male and female young adults

Correlating the pulse rate changes after the stimulation with upbeat music against student's i.e., male and female students separately, the correlation coefficient obtained was -0.247 and -0.234 respectively. Since the correlation coefficient is near 0, it indicates a weak linear relationship between these two data (Fig. 2, Fig. 3).

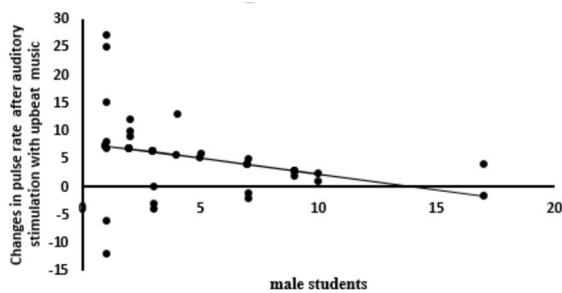


Figure 2: Correlating the pulse rate changes after the auditory stimulation with upbeat music against number of male young adults.

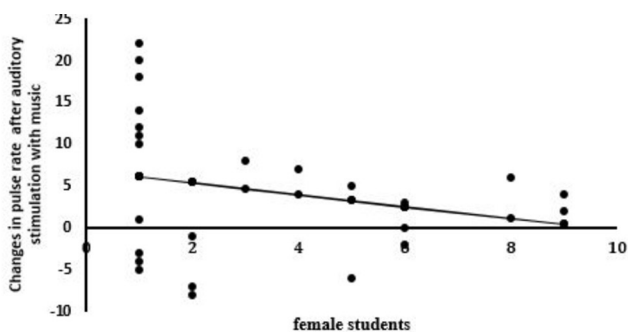


Figure 3: Correlating the pulse rate changes after auditory stimulation with upbeat music stimulation against number of female young adults.

Results of the present study shows that there was a wide range in the number of pulse per minute in normal young adults aged between 19 to 24 years, at resting state. Pulse rate at rest was ranging between 51 to 112 per minute with a mean pulse rate 76 per minute in healthy young males. In healthy young females the range of pulse rate was found between 54 to 98 per minute with a mean value of 72 per minute. Following auditory stimulation with upbeat music, variation in the number of pulses ranging from 53 to 115 per minute with mean value 79 per minute in normal young adult males and females of same age group have shown the pulse rate ranging from 54 to 100 per minute with mean pulse rate was 77 per minute (Table I). A significant variation in mean pulse rate was observed, before and after listening to the upbeat music both in male and female students (Table I). General observation shows males have an increase in number of pulse per minute compared to females even at rest and following listening to upbeat music (Table I).

Table I: Comparison of variation in pulse rate, before and after listening to music both in males and female students

Groups	Age [years]	Pulse rate		P value
		Before music	After music	
Males	19 to 23	76.04±12.71	79.21±14.0*	0.000
Females	20 to 24	72.90 ±9.78	77.88±9.84*	0.000

Paired t test, p<0.05, *** p<0.000

When we observed the pattern of the pulse before listening to upbeat music and variation in the pattern of pulse after listening to upbeat music was noticed. (Fig. 4). Pulse recording (Fig. 2) has shown an increase in the pulse rate following auditory stimulation with upbeat music. The rhythm of the radial pulse recorded was regular, as spacing between each wave was constant, which is observed before and after listening to upbeat music. The normal character of the pulse was maintained with a dicrotic notch and anacrotic wave is visible clearly even after listening to upbeat music. The amplitude of the wave is decreased with an increase in pulse rate after auditory stimulation with upbeat music in few participants. The condition of the arterial wall was normal on palpation in all the participants.

DISCUSSION

Arterial pulse refers to the rhythmic expansion of the arterial wall due to the transmission of pressure waves along the wall of the arteries during the systole of the heart (31). We have hypothesized that auditory stimulation with upbeat music stimulates cardiac functioning. Results obtained in the present study shows the variation in pulse rate both in male and female students following auditory stimulation with upbeat music. It was also observed that male students have shown an increase in pulse rate compared to females between the same age group.

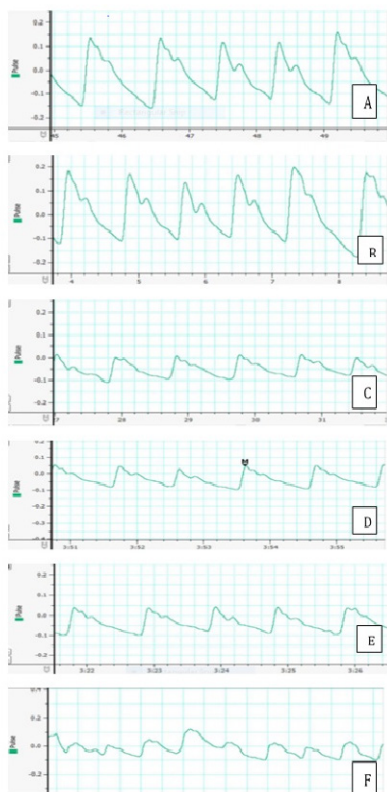


Figure 4: Graphical representation of Radial pulse. Normal pattern of radial pulse before listening to upbeat music [A] Increased pulse rate after listening to upbeat music [B] Decreased pulse amplitude after listening to upbeat music [C,D,E], Decreased pulse amplitude and increased pulse rate [F]

Studies show that auditory stimulation with music stimulates the brain, which further grasps the rhythm and sends signals to different organs of the body, including the heart (11). When the tempo of the music is fast, it accelerates the contraction of the heart (28). Probably this could be the reason for the rise in pulse rate. The beneficial effect of fast, upbeat music on the cardiovascular and respiratory system was found to be more effective in subjects who were trained to listen to the music and the subjects who were trained to coordinate their respiration with musical beats (21).

In the present study, we observed about 26% of females and 23% of males have shown to decrease in their pulse rate after listening to upbeat music. The decrease in heart rate is probably due to the physiological condition or current mood of the subject while listening to the song. Studies indicate that these variations could be due to other influencing factors such as, the subject is feeling angry, depressed or tensed at that particular moment. In some people Listening to a fast tempo song can feel good because the music gives the subject an outlet for the frustration (32).

The present study also has shown a few neutral groups, where no change in pulse rate was observed before and after listening to the upbeat song. In this case, a stronger

possibility is that music affects the heart but fails to produce a more measurable physiological response, thus neither an increase nor decrease in heart rate is seen. Current research reveals that music does affect the heart one way or another regardless of the listener’s preferences or familiarity of the subject to the song (33). Recorded pulse waves of radial artery from the individuals with increasing heart rate were found to have normal rhythm, which means normal spacing between successive pulse waves. This indicates that auditory stimulation by upbeat music has not affected the normal functioning of the heart but the contraction rate of the ventricle has increased, shown by the increase in rate and it is in regular intervals. The amplitude of the pulse is reduced, which indicates stroke volume is reduced due to rapid contraction of the ventricle as less time for ventricular filling during an increased heartbeat (34). Radial pulse recordings also have shown the normal character of the pulse wave with a dicrotic notch.

The limitation of this study include limited numbers of subjects in the study. In addition to measuring the pulse rate, the addition of the respiratory rate and blood pressure recording would have helped to analyze autonomic functions more accurately. Therefore, a further detailed study is needed to probe the effect of music on cardiovascular functions in healthy participants as well as patients suffering from heart-related problems.

CONCLUSION

The present study highlights that auditory stimulation with upbeat music has more stimulatory influence on brain and increase sympathetic outflow over the heart. Due to which increase in pulse rate showed by as maximum number students. Overall observation shows that auditory stimulation by upbeat music has increased the sympathetic nerve activity thereby causing the alteration in the properties of the radial pulse. Therefore this study paves a way for a new approach that, music that has a faster tempo, has a more arousal effect and will further stimulate cardiovascular functions.

ACKNOWLEDGEMENTS

The authors are thankful to the Manipal Academy of Higher Education for the encouragement and the support to conduct student research activities. The authors are also thankful to the HOD, Department of physiology MMMC for permitting to use of the laboratory instrument for this research activity.

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