10.5005/jp-journals-10070-0002

STUDENT RESEARCH

Effect of Type of Music on Auditory Reaction Time in Young Adult Males

[1]Rajshree R Gupta, [2]Muskaan Nagpal, [3]Ritu Sharma

ABSTRACT

Introduction: Distractions such as the use of mobile phones or listening to music while driving can prove to be fatal. Reaction time (RT) is the time interval between the application of a stimulus and the appearance of appropriate voluntary response by an individual; it can be used to assess the individual's efficacy to respond to any stimulus in daily life. Choice of music and its influence on the central nervous system (CNS) and hence RT is linked to many neurophysiological reactions.

Objectives: The present study was aimed to determine the effect of soft and hard rock music; played at low and high volumes on auditory reaction time in 52 young adult males. The auditory stimulation used was a buzzer simulating honking. Thus this study may help to understand if some types of music should be avoided or preferred while driving.

Materials and methods: A total of 52 students from medical college-aged between 18 to 25 years; body mass index (BMI) between 18.5 to 25 kg/m^2 participated in the study. Instrumental soft and hard rock music was delivered through two speakers. The low volume of 60 dB and a high volume of 80 dB were gauged by the sound level meter. Auditory reaction time (ART) was recorded with an auditory stimulus delivered from digital reaction time apparatus. After a practice session for an acquaintance, a baseline recording of auditory reaction time without music was recorded. This was followed by ART recording with soft music with low and high volumes and hard rock music with low and high volumes. The difference in mean ART of each music setting was then compared with mean baseline ART using a paired t-test.

Result: The mean ART for sound stimulus for soft music at low volume showed improvement while it showed the slower response for high volume; though the difference in mean was not statistically significant ($p > 0.05$).

Faster ART was observed for hard rock music for both low and high volume which was not statistically significant.

Conclusion: The varied outcomes suggest a differing preference of type of music and volume that might have affected the arousal and alertness of the participants and hence the reaction time. This is a significant deduction which brings out the importance to conduct similar studies incorporating the taste, preferences of music.

[1]Assistant Professor, [2]Student, [3]Tutor

[1,3]Department of Physiology, Army College of Medical Sciences, New Delhi, India

[2]Army College of Medical Sciences, New Delhi, India

Corresponding Author: Muskaan Nagpal, Student, Army College of Medical Sciences, New Delhi, India, Phone: +919657561006, e-mail: muskaan_ngpl@rediffmail.com

Keywords: Auditory reaction time, Hard rock music, High volume, Low volume, Reaction Time, Soft music.

How to cite this article: Gupta RR, Nagpal M, Sharma R. Effect of Type of Music on Auditory Reaction Time in Young Adult Males. Journal of Medical Academics 2018;1(1): 5-9.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Distractions like the use of mobile phone, listening to music can be fatal while driving a vehicle.[1,2]

To avoid such accidents, the promptness with which the individual reacts to any danger while driving should be considered. This primarily depends on how efficiently the individual reacts to the stimulus by the motor response; which in turn is based on stimulus processing, decision making and response programming in the CNS.[3,4]

Music is a universal art, and recently researchers have tried to unravel the neurophysiology of music. Musical stimuli have been shown to activate pathways in several brain areas associated with emotional and cognitive behaviors.[5]

Soft music may be defined as slow-paced music while hard rock music is music with a strong beat.

Reaction time (RT) is the time interval between the application of a stimulus and the appearance of appropriate voluntary response by an individual. Reaction time can be used to assess the individuals' efficacy to respond to any stimulus in daily life, e.g., a slower than normal RT while driving can have fatal results. Various factors that affect the reaction time are intensity and duration of the stimulus, age, and gender of participant.[6]

Choice of music and its influence on the CNS and hence on RT is linked to many neurophysiological reactions attesting changes in the flow of excitations in the corticothalamic and corticolimbic circles. Listening to music is accompanied by a partial replacement of the dominant alpha rhythm by activity in the frequency range of beta, theta, and delta waves and with a change to some vegetative reactions. Listening to stimulating music can influence certain factors (e.g., arousal) that affect reaction time. RT is faster at an intermediate level of arousal and slower if the subject is too relaxed or too tensed.[7]

The present study examines the effect of soft and hard rock music on ART in young adult males. The auditory stimulus in the form of buzzer simulates the traffic condition while driving and listening to music of different types. This study may help to understand if some types of music should be avoided or preferred while driving.

AIM

To determine if different types of music have an effect on auditory reaction time in young adult males.

OBJECTIVE

- To record the baseline ART without music
- To study the effect of soft music at the low and high volume on ART.
- To study the effect of hard rock music at the low and high volume on ART.

MATERIALS AND METHODS

This study is a human physiology experimental, analytical study where baseline recording was taken as a control group and subsequent recording with music as an experimental group. Institutional ethical committee clearance was obtained before the commencement of the study. Written consent from the participants was also obtained.

A total of 52 undergraduate medical students enrolled in a medical college at Delhi were randomly selected for the study. They would be referred to as 'subjects,' hereafter

The inclusion criteria were that the subjects must be healthy young adult males of age ranging from 18 to 25 years with normal hearing and vision; BMI ranging from 18.5 to 25 kg/m^2.[8] Females were not included in the study, to avoid discrepancy in the results due to the effect of the menstrual cycle on ART.[9] Any subject suffering from sensory, motor or cognitive dysfunction, acute or chronic illness, those with any auditory dysfunction, or analgesics, hallucinogenic drugs, alcohol, and smokers were not be included.

The instrument used for this study was digital reaction time apparatus manufactured by Instruments Manufacturing CORP (Ambala, India). It has an operator (investigator) side with regulators to provide auditory and visual stimuli and a training (subject) side for the participant as depicted in Figures 1 and 2 respectively. In the present study, one auditory stimulus was used.

Soft music and hard music pieces were selected from the Yamaha PSR E 203 keyboard. The low (60 dB) and high (80 dB) volumes were gauged for soft and hard rock music with the help of a sound level meter.10

The music was delivered from the same distance and direction.

Subjects were briefed about the instrument and the aim and objective of the study one day before the study and were asked to have light breakfast and avoid stimulant beverages before reporting for the test.

Procedure

(a) The study was conducted in a quiet room at the same time of the day (1000 to 1100 hours) maintained at the same room temperature. On the day of the experiment, the subjects were made to fill up their demographic details which also included details of exclusion and inclusion criteria as listed above. Once selected, a detailed history and physical examination were carried out. Height and weight were measured by a standard procedure to calculate BMI. The eligible subject was asked to sign the written consent followed by a briefing of the procedure. The subject was briefed about the procedure after which he was asked to sit comfortably on a chair on

Fig. 1: Digital reaction time apparatus operator (investigator) side

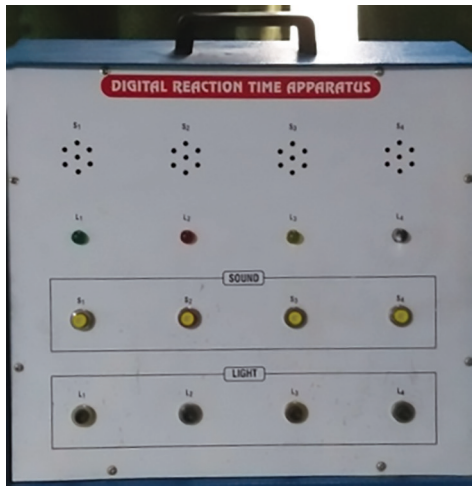

Fig. 2: Digital reaction time apparatus Training (participant) side

the training side of the instrument and was acquainted about the instrument and the procedure.

The detailed procedure is as follows:

(b) Baseline recording without music: The operator presented an auditory stimulus, and the subject was instructed to stop the given stimulus using a knob. Three recordings were taken and mean was taken as auditory reaction time in milliseconds.

(c) Readings were taken with soft music at low and high volumes played for two minutes each. The time taken for changing the volume was 2 to 5 seconds.

(d) After a gap of 5 minutes; the above procedure was repeated for hard rock music.

Data Collection and Analysis

Data were entered in a logbook and then on an Excel sheet. The mean of ART under different conditions was calculated. The difference in mean ART was then compared with a mean of the baseline ART, using a paired t-test. The p-value of less than 0.05 was considered as a statistically significant result.

OBSERVATIONS AND RESULTS

Table 1 shows the comparison of mean auditory reaction time under the influence of soft music at low and high volume with the mean of baseline ART. Though mean ART for sound stimulus at low volume showed improvement and for high volume, it was slower; the difference in mean was not statistically significant (p >0.0)

Table 2 shows the comparison of auditory reaction time for sound stimulus under the influence of hard rock music at low and high volume with the mean of baseline ART. The improvement in reaction time is observed for the auditory stimulus for both types of volume. The difference in mean ART was not statistically significant (p >0.05) when it was compared to baseline mean ART.

DISCUSSION

The importance of music in daily life has lead to a number of studies; from addressing the brain regions involved in its appreciation to its association with road accidents. Some controlled only for the familiarity of the stimuli, while others relied on pleasantness, and others still on musical preferences.[11,12]

Table 1: Effect of soft music on ART (n = 52)

Stimulus sound (Buzzer)	*Mean ART (millisecond)*	*SD*	*Significance (p-value)*
Baseline	780.4	+ 184.7	
Soft music at low volume	763.70	+187.6	>0.05
Soft music at high volume	794	+232.8	>0.05

Table 2: Effect of hard rock music on ART (n = 52)

Stimulus: Sound (Buzzer)	*Mean ART (millisecond)*	*SD*	*Significance (p-value)*
Baseline	780.4	±184.7	
Hard music at low volume	738.2	±193.9	>0.05
Hard rock music at high volume	716.6	±209.6	>0.05

Effect of soft music at low (60dB) and high volume (80dB) (Table 1)

Table 1 shows the effect of soft music when played at low volume (60dB) on mean ART when compared with mean baseline ART for one auditory stimulus. Though mean ART for sound stimulus showed improvement, the difference in mean was not statistically significant (p >0.05).

A similar study was conducted in the past in which mean AVRT of 30 students was recorded first without music and then with music in the background played on a laptop. The music presented was of two types; a verbal heavy metal of Bollywood movie and instrumental violin. The music played on the laptop was presented with a fixed volume to all subjects. The study observed that the mean ART for both types of music was lesser than ART without background music for both types of music. Statistically significant improvement in ART was also noted for low and medium pitch sounds when recorded with instrumental background music (violin), indicating facilitation in the processing of stimuli. Average of 10 recordings for each sound pitch was considered for statistical analysis. The present study did not find any significant change in ART with soft music at low or high volume. The reason could be that different types of music played in both studies or the mean of 10 recordings for each of the stimulus taken into consideration while in the present study the stimulus was presented randomly only once.

The sound stimulus showed slower reaction though not statistically significant (p >0.05) with high volume.

A similar study was conducted in the year 2000 with the aim to study the effect of music amplitude on the relaxation response. The amplitude of the music was changed every 3 minutes in a randomized order so that each subject received loud (80–90 dB), medium (70–80dB) or soft (60–70 dB). One hundred and forty music and nonmusic lovers participated in the study. The choice of amplitude differed between the music majors and nonmajors. Nonmajors preferred the loud music the most while majors prefer this level the least. Softer music (60-70 dB) is preferred for the purpose of relaxation in comparison to louder levels for young adults. Even in the overwhelming positive response for soft music for relaxation, individuality did exist.[10]

Effect of hard rock at low volume (60 dB) And at high volume (80 dB) on ART (Table 2)

Our study did not observe any significant difference in ART in the presence of hard music at either low or high volume as shown in Table 2. Though the volume change showed improvement in reaction time; though the difference in mean was not statistically significant ($p > 0.05$).

A similar study conducted in the past on effects of auditory and visual distractions on reaction time in 2012. The study was conducted on a total of 17 volunteer-7 males and 10 females ranging in age from 19 to 22. In the participants listened to the song "shots" by LMFAO, using headphones at 70% of the maximum volume of an iPod Nano (mac, California). Reaction time was recorded by asking the subject to hold the space bar as soon as they saw the cat appear on the screen. The study too concluded that the distractions of loud music did not lead to an increase in reaction time, heart rate, or blood pressure during a simple detection task. The study concluded that while all three distraction conditions in the study invoked an average increase in reaction time as compared to the control condition (without any distractions). The music condition showed the lowest percent increase (1.58%) and the texting condition had the highest percent increase (94.94%). The conversation condition showed a percent increase of 13.84%.[13]

The present study showed faster ART than baseline recordings for high volume though not statistically significant, and this could be because high volume may have led to better alertness and arousal amongst the subjects. The music conditions and stimuli were different in both the studies.

A study was conducted by Pereira et al. using a listening test and a functional magnetic resonance imaging (fMRI) experiment to understand the role of familiarity with music in the brain and musical preferences. First, a listening test was conducted, in which participants rated the familiarity and liking of song excerpts from the pop/rock repertoire, allowing to select a personalized set of stimuli per subject. Then, a passive listening paradigm in fMRI was used to study music appreciation in a naturalistic condition with increased ecological value. Brain activation data revealed that broad emotion-related limbic and paralimbic regions, as well as the reward circuitry, were significantly more active for familiar relative to unfamiliar music. Smaller regions in the cingulate cortex and frontal lobe, including the motor cortex and Broca's area, were found to be more active in response to liked music when compared to disliked one. The study concluded that familiarity seems to be a crucial factor in making the listeners emotionally engaged with music, as revealed by fMRI data.[11]

In the present study, the investigator faced the same challenge that if a particular music was not liked/preferred by the individual while listening to one such music piece, this could lead to boredom and change in emotions.

In the present study, each type of music was played for two minutes, so further studies may be carried out to ascertain the time required to record a noticeable change in ART.

LIMITATION

- It is possible that the subjects were not familiar with the instrumental music played (or the music was not of their liking). Thus minimum distraction /interest was exhibited in it. This fact probably was important in not affecting their ART significantly.
- The soft and hard rock music was played for 2 minutes at low and high volume each which could be a short duration for any significant change to occur in ART.

SUGGESTIONS

- A study may be undertaken in which ART can be studied while the individual listens to his favorite piece of music at a volume selected by him.
- It is recommended that the future studies may be conducted where the different types of music may be played for the longer duration of time ie more than 2 minutes.
- A similar study may be planned with the use of headphones instead of speakers

CONCLUSION

This study was aimed to determine the effect of soft music and hard music at the low and high volume on auditory reaction time in young adult males. The motivation for this topic arose from the results of other research papers that demonstrated the influence of music on a certain type of activities and listening to music while driving and leading to road accidents.

Baseline readings of the mean of auditory reaction time for a sound stimulus in the form of a buzzer were taken. It was observed that soft music at low volume, the time is taken to respond to the auditory stimulus was increased. Though the change was not statistically significant ($p > 0.05$).

In the presence of soft music at high volume, an increase in auditory reaction time was observed, though statistically not significant ($p > 0.05$).

When hard rock music was played at low and high volumes, the ART was faster, though the change was not statistically significant ($p > 0.05$).

In conclusion, this study has tried to determine a change in ART in the presence of soft music and hard music at low and high volume in young adult males. The result of the study can be utilized for further research projects under different types and duration of music in the background during a complex task such as driving.

REFERENCES

1. Beh HC, Hirst R. Performance on driving-related tasks during music. Ergonomics 1999;42(8):1087-1098.
2. Dibben N, Williamson VJ. An exploratory survey of in-vehicle music listening. Psychol Music 2007; 35(4):571-589.
3. Brookhuis K, Waard DD, Mulder B. Measuring driving performance by car-following in traffic Ergonomics 1994;37(3):427-434.
4. Lamble D, Kauranen T, Laakso M, Summala H. Cognitive load and detection thresholds in car following situations: safety implications for using mobile (cellular) telephones while driving. Accid Anal Prev 1999;31(6):617-623.
5. Boso M, Politi P, Barale F, Enzo E. Neurophysiology and neurobiology of the musical experience. Funct Neurol 2006;21(4):187-191.
6. Gandhi PH, Gokhale PA, Mehta HB, Shah CJ. A comparative study of simple auditory reaction time in blind (congenitally) and sighted subjects. Indian J Psychol Med. 2013;35(3):273-277.
7. Mesko M, Strojink V, Videmsek M. The effect of listening to techno music on reactions to visual stimuli. Acta Gymnica 2009; 39(1):67-73.
8. Nikam LH, Gadkari JV. Effect of age, gender and body mass index on visual and auditory reaction times in Indian population. Indian J Physiol Pharmacol 2012;56(1):9499.
9. Kumar S, Mufti M, Kisan R. Variation of Reaction Time in Different Phases of Menstrual Cycle. J Clin Diagn Res 2013; 7:1604-1605.
10. Staum MJ.Effect of music amplitude on the relaxation response. Journal of music therapy 2000;XXXVII(1):22-39.
11. Pereira CS, Teixeira J, Figueiredo P, Xavier J, Castro SL, Brattico E.Music and emotions in the brain: familiarity matters. PLoS ONE:e27241[INTERNET] 2011 Nov.
12. Wang D-Y, Jimison Z, Richard D, Ching-Hua Chuan C-H. PROCEEDINGS of the Eighth International Driving Symposium on Human Factors in Driver Assessment, Training and Vehicle Design. Effect of listening to music as a function of driving complexity: A simulator study on the differing effects of music on different driving tasks 2015:253-259.
13. Anderson E, Bierman C, Franko J, Zelko A. The effects of audio and visual distractions on reaction time :university of Wisconsian-Madison 2012 May. (cited 2017 jun 17); pp 16 Available from: http://jass.neuro.wisc.edu/2012/01/Lab%20603%20Group%2014%20FINAL.pdf