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RESEARCH ARTICLE

Does music have any effect on visual reaction time in young males? A comparative study

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ABSTRACT

Background: Reaction time (RT) is the time interval between the application of a stimulus and the appearance of appropriate voluntary response. It can be used to assess the efficacy to respond to any stimulus in daily life, for example, traffic signal. **Aims and Objectives:** This study aims to determine the effect of soft and hard rock music; at low and high volumes on visual RT (VRT) in young adult males. **Materials and Methods:** The study included 52 undergraduate medical students aged between 18 and 25 years; body mass index between 18.5 and 25 kg/m^2. Instrumental soft and hard rock music was delivered through speakers at low volume (60 dB) and high volume (80 dB), gauged by sound level meter. VRT was recorded using digital RT apparatus. A baseline VRT for red, green, and yellow colors without any background music was recorded. The mean of three recordings for each color stimulus was considered. Soft music was played first at low volume followed by high volume for 2 min each. After a gap of 5 min, the procedure was repeated using hard rock. The stimuli were provided randomly. Post-exposure VRT was recorded after each session. Paired *t*-test was employed to compare the difference in mean of each session with mean baseline VRT. **Results:** Statistically significant faster RT was observed for green color with soft music at high volume ($P < 0.02$) while it was slower for yellow color post-exposure to hard rock music ($P < 0.0004$). **Conclusion:** The varied pattern of result may indicate differing choice of music which may have affected his alertness.

KEY WORDS: Reaction Time; Visual Reaction Time; Hard Rock Music; Soft Music; High Volume; Low Volume

INTRODUCTION

Distractions such as listening to music or conversation while driving can lead to fatal accidents while driving a vehicle.[1,2] To avoid such accidents, the promptness with which the individual reacts while driving should be considered. This depends on promptness of motor response, which, in turn, is based on stimulus processing, decision-making, and response programming in the central nervous system (CNS).[3,4] 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 individuals' efficacy to respond to any stimulus in daily life. Various factors that affect the RT are intensity and duration of stimulus, age and gender of participant, and effect of practice.[5]

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Music is a universal art form. While the soft music may be defined as slow paced and soothing, the hard rock music is a type of music with a strong beat. Many researchers have tried to unravel the neurophysiology of music. Activation of pathways in brain areas associated with emotional and cognitive behaviors in response to music has been studied.[6]

Choice of music and its influence on the CNS and hence on RT are linked to a number of 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 RT. RT is faster at an intermediate level of arousal and slower if subject is too relaxed or too tensed.[7]

The present study examined the effect of soft and hard rock music on visual RT (VRT) in young adult males. The colors for visual stimuli used simulate the traffic signal lights. This study may help to understand if some types of music should be avoided or preferred while driving.

MATERIALS AND METHODS

This is a human physiology experimental, comparative study where baseline recording was taken as control group and subsequent recording with music as experimental group. Institutional ethical clearance and consent of participants were obtained before commencement of the study. Fifty-two young adult males aged 18–25 years within body mass index 18.5–25 kg/m^2 with normal or corrected vision were randomly selected for the study.[8] Exclusion criteria included person having color blindness, consumption of alcohol and hallucinogenic drugs and females to avoid discrepancy in the study due to the effect of menstrual cycle on VRT.[9] Digital RT apparatus, Figures 1 and 2 manufactured by instruments manufacturing CORP (Ambala, India), was the instrument used. Three visual stimuli in the form of red, green, and yellow light simulating traffic signal lights were provided as the stimuli.

Soft music and hard music pieces selected from the Yamaha PSR E 203 keyboard at low (60 dB) and high (80 dB) volumes gauged with the help of sound level meter were delivered from the same distance and direction using two speakers.[10]

After proper briefing, the baseline recording without music was obtained by providing the three visual stimuli in the form of green, yellow, and red light randomly thrice each. The mean value obtained was considered as the baseline VRT. Readings were taken with soft music at low and high volumes (played for 2 min each) where the subject was tested randomly for three visual stimuli while listening to the music. The time taken for changing the volume was 2–5 s post-exposure reading which was taken similarly. The above procedure was repeated for hard rock music after a gap of 5 min. Data were entered into an Excel sheet. The mean of VRT under different conditions was calculated. The difference in mean VRT was then compared with mean of the baseline VRT, using paired *t*-test. $P < 0.05$ was considered as statistically significant result.

RESULTS

Music has been linked to enhanced cognitive and intellectual skills and its ability is associated with enhanced visual cognitive processing.[11]

The present study involved 52 young adult males as subjects. The VRT was measured before, during, and immediately after the exposure of different types of music. Table 1 shows baseline readings of the mean of VRT for red, green, and yellow colors. Among them, yellow color showed the fastest RT.

Table 2 shows comparison of mean VRT with baseline recording for red, green, and yellow color stimuli under different background situations.

Figure 1: Operator side

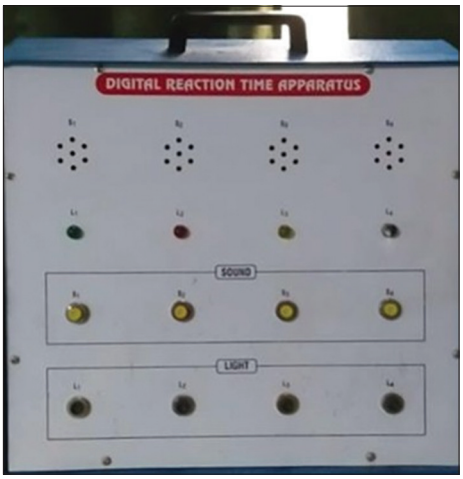

Figure 2: Participant side

Table 1: Baseline recording of VRT (***n***=52)

Color stimulus	Mean baseline VRT (ms)±SD
Red	640.8±140.3
Green	666.8±128.8
Yellow	630.2±110.0

VRT: Visual reaction time, SD: Standard deviation

Table 2: Comparison of mean VRT with baseline recording for red, green, and yellow color stimuli under different background situation (***n***=52)

Types of background	Mean VRT (ms) with red color±SD	*P*-value	Mean VRT (ms) with green color±SD	*P*-value	Mean VRT (ms) with yellow color±SD	*P*-value
Software music at low volume	615.2±199.4	>0.05	641±144.3	>0.05	677.2±245.6	>0.05
Software music at high volume	621±91.5	>0.05	591.3±192	<0.02	609±157.7	>0.05
Post-exposure to soft music	676.8±182.7	>0.05	641.4±153.7	>0.05	617.7±141	>0.05
Hard music at low volume	657.3±238.5	>0.05	656±172.7	>0.05	591.5±190.5	>0.05
Hard music at high volume	597.6±205	>0.05	629.8±161.3	>0.05	614.5±164.2	>0.05
Post-exposure to hard music	643±168.9	>0.05	618.8±165.1	>0.05	727.7±156.2	<0.0004

VRT: Visual reaction time, SD: Standard deviation

With soft music at low volume in background, the mean VRT for red and green stimuli showed improvement, whereas for yellow color stimuli, the mean VRT was slower. The difference in mean was not statistically significant. While all three visual stimuli showed improvement in VRT, the mean VRT with green color showed statistically significant difference when compared to baseline mean VRT ($P < 0.0$) with soft music at high volume.

With hard music at low volume in background improvement in RT is observed with green and yellow color stimuli, where the RT was slower with red color. The difference in mean VRT was not statistically significant ($P > 0.05$) when compared to baseline mean VRT. The mean VRT for all visual stimuli was faster when compared to baseline VRT though the difference in mean was not statistically significant ($P > 0.05$) with hard music at high volume in background.

Post-exposure to soft music at low volume and high volume improvement in RT is observed with green and yellow color stimuli, whereas RT was found to be slower with red color. The difference in mean VRT was not statistically significant ($P > 0.05$) when compared to baseline mean VRT. Post-exposure to hard music at low and high volume, the mean VRT for green color stimulus was faster when compared to baseline VRT. The mean VRT for red and yellow colors was slower when compared to baseline VRT, the change in mean for yellow color was statistically significant ($P < 0.05$).

DISCUSSION

Listening to music and its importance in addressing brain regions involved in its appreciation to its association with road accidents has led to a number of studies.[12] Effect of soft music at low volume in background on mean VRT when compared with baseline VRT for three-color stimuli showed improvement for red and green color. For yellow color, the mean VRT was slower than baseline VRT. Though the difference in mean was not statistically significant ($P > 0.05$). The comparison of VRT under the influence of soft music at high volume with the mean of baseline VRT for all three visual stimuli showed improvement in VRT, the change in mean VRT with green color was statistically significant ($P < 0.05$).

Our study did not observe any significant difference in VRT in the presence of hard music at either low volume or high volume. Although statistically insignificant, improvement in RT was observed with green and yellow, whereas RT was slower with red color in the presence of hard music at low volume. With hard music at high volume in background, the mean VRT for all visual stimuli was faster when compared to baseline VRT though the difference was not statistically significant ($P > 0.05$).

Post-exposure recording for VRT for red, green, and yellow color stimuli after the influence of soft music at low and high volume with mean of baseline VRT shows improvement for green and yellow and slower RT for red color. Though the difference was not statistically significant ($P > 0.05$). Post-exposure recording after the influence of hard music at low and high volume with mean of baseline VRT showed statistically significant ($P < 0.05$) increase in RT for yellow color when compared to baseline VRT. Statistically insignificant ($P > 0.05$) increase in RT for red color and faster response for green color was also observed.

Music is known to alter mood which can further influence human behavior. As predicted by the mood-arousal hypothesis, in case of boredom or drowsiness, music can lead to an optimal arousal level which could benefit during driving. In contrast, another study concluded that listening to music can even lead to a more relaxed body state.[13]

A study was conducted in the past on 30 students where mean VRT was recorded first without music and then with music in background. Two types of music were presented at fixed volume; a verbal heavy metal of Bollywood movie and instrumental violin. The study observed that the mean VRT for both types of music was lesser than VRT without background music. Improvement in VRT for yellow and green color with both types of music in background was found.

Another study was conducted on 17 volunteers aged 19–22 on the effects of auditory and visual distractions on RT in 2012. Participants listened to song "shots" by LMFAO. RT was recorded by asking the subject to hold 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 RT, heart rate, or blood pressure during simple detection task.

Listening to music condition showed the lowest percent increase (1.58%) and the texting condition had the highest percent increase (94.94%).[14] In another study on 10 subjects aimed to establish the influence of techno music on VRT concluded significant shortening of RT 45 s after listening to 30 min techno music. RT was not shortened during the listening of techno music.[7]

Strength

The present study examined the effect of soft and hard rock music on VRT in young adult males. The colors for visual stimuli used simulate the traffic signal lights. This study may help to understand if some types of music should be avoided or preferred while driving.

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 VRT significantly. The soft and hard rock music was played for 2 min at low and high volume each which could be a short duration for any significant change to occur in audio VRT.

CONCLUSION

These results indicate a varied pattern of outcomes. Differing preference of the type of music and volume might have affected arousal and alertness of the participants (VRT). This is a significant deduction which brings out the importance to conduct similar studies incorporating the taste, preferences, and preferred volumes of music for different individuals while driving.

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REFERENCES

1. Beh HC, Hirst R. Performance on driving-related tasks during music. Ergonomics 1999;42:1087-98.
2. Dibben N, Williamson VJ. An exploratory survey of in-vehicle music listening. Psychol Music 2007;35:571-89.
3. Brookhuis K, Waard DD, Mulder B. Measuring driving performance by car-following in traffic. Ergonomics 1994;37:427-34.
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;31:617-23.
5. 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;35:273-7.
6. Boso M, Politi P, Barale F, Enzo E. Neurophysiology and neurobiology of the musical experience. Funct Neurol 2006;21:187-91.
7. Mesko M, Strojink V, Videmsek M. The effect of listening to techno music on reactions to visual stimuli. Acta Gymnica 2009;39:67-73.
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;56:94-9.
9. Kumar S, Mufti M, Kisan R. Variation of reaction time in different phases of menstrual cycle. J Clin Diagn Res 2013;7:1604-5.
10. Staum MJ, Brotons M. The effect of music amplitude on the relaxation response. J Music Ther 2000;37:22-39.
11. Smucny J, Rojas DC, Eichman LC, Tregellas JR. Neuronal effects of auditory distraction on visual attention. Brain Cogn 2013;81:263-70.
12. Pereira CS, Teixeira J, Figueiredo P, Xavier J, Castro SL, Brattico E. Music and emotions in the brain: Familiarity matters. PLoS One 2011;6:e27241.
13. van der Zwaag MD, Dijksterhuis C, de Waard D, Mulder BL, Westerink JH, Brookhuis KA, *et al*. The influence of music on mood and performance while driving. Ergonomics 2012;55:12-22.
14. Anderson E, Bierman C, Franko J, Zelko A. The Effects of Audio and Visual Distractions on Reaction Time: University of Wisconsian-Madison; 2012. Available from: http://www.jass.neuro.wisc.edu/2012/01/Lab%20603%20Group%2014%20FINAL.pdf. [Last accessed on 2017 Jun 17].

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