

Comparison between auditory and visual simple reaction times and its relationship with gender in 1st year MBBS students of Jawaharlal Nehru Medical College, Bhagalpur, Bihar

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Abstract

Objective: This study was to find out whether the simple reaction time was faster for auditory or visual stimulus. And also whether there is any relationship between Reaction time and gender of an individual. **Methodology:** 32 first year M.B.B.S. students were divided randomly into 2 groups each consisting of 16 male students and 16 female students. Both the groups were performed for the visual and auditory tests. The tests were taken from the Direct RT software program from a laptop. The Direct RT software consists of Test lab visual and Test lab sounds to test the reaction times to visual and auditory stimuli. For each group both the visual and auditory reaction time test were conducted and, the data was taken. The mean reaction time was calculated excluding the first and last values. **Results:** The results shows that the mean visual reaction time is around 293.37 ± 13.01 milliseconds as compared to the mean auditory reaction time of around 248.61 ± 12.84 milliseconds. The mean visual reaction time is 285.59 ± 12.53 milliseconds in males and 301.15 ± 13.49 milliseconds in females. The mean auditory reaction time is 246.88 ± 14.33 milliseconds in males and 250.35 ± 11.36 milliseconds in females. **Conclusion:** This shows that the auditory reaction time is faster than the visual reaction time. And also males have faster reaction times when compared to females for both auditory as well as visual stimuli.

Keywords: Reaction Time, Auditory Stimuli, Visual Stimuli, Neuromuscular-Physiological Response, Auditory Cortex, Visual Cortex, Muscle Contraction.

Introduction

Reaction time (RT) is the time between the presentation of a sensory stimulus and the subsequent behavioral response. Simple reaction time is usually defined as the time required for an observer to detect the presence of a stimulus. This physical skill is closely related to human performance. It represents the level of neuromuscular coordination in which the body through different physical, chemical and mechanical processes decodes visual or auditory stimuli which travel via afferent pathways and reach the brain as sensory stimuli.

Simple reaction time can be determined when an individual is asked to press a button as soon as a light or sound appears. Research done by Pain & Hibbs

reference [1], shows that simple auditory reaction time has the fastest reaction time for any given stimulus. A study done by Thompson *et al.*, reference [2] has documented that the mean reaction time to detect visual stimuli is approximately 180 to 200 milliseconds, whereas for sound it is around 140-160 milliseconds. On the other hand, there are also researches done by Yagi *et al.*, reference [3], that show that reaction time to visual stimuli is faster than to auditory stimuli. Research by Verleger, reference [4] also confirms that visual reaction time is faster than auditory reaction time during or after exercise.

There are various factors that affect the reaction time to a stimulus. Factors like intensity and duration of the stimulus, age and gender of the participant, effect of practice can affect the reaction time of an individual to

Manuscript received 4th June 2016
Reviewed: 14th June 2016
Author Corrected: 25th June 2016
Accepted for Publication 6th July 2016

a particular stimulus. For example, there are relative differences between the reaction time to visual and auditory stimuli between genders.

Male athletes tend to be faster than their female counterparts in responding to different stimuli. Researches done by Engel, reference [5], show the reaction time to sound to be faster in males when compared to females. Studies done by Dane *et al.*, reference [6], show the difference in reaction time in eye-hand reaction time among male and female handball players.

The purpose of this study was to find out whether the simple reaction time was faster for auditory or visual stimulus and the effect of gender on it for a particular age group

Methodology

The study was done in department of Physiology Jawaharlal Nehru Medical College Bhagalpur. 32 first year M.B.B.S. students were randomly chosen for the study. The subjects were divided into 2 groups each consisting of 16 male and 16 female candidates. All the subjects were between age group 17 to 22 years. For each group both the visual and auditory tests were performed. The tests were taken from the DirectRT

software program in the laptop. The tests for visual reaction time were taken from the ‘testlabvisual’ file in the DirectRT program. Before starting the test a complete 2 days exhaustive training was given to the subject so that they are well acquainted with the procedure going to be done on them. The consent form were signed by each subject.

The subjects were asked to give individual file numbers under the ‘enter codes’ menu, in order to access the data after the test. In the testlabvisual test, the subjects were asked to press the ‘space bar’ key, every time they saw a yellow box on the screen. Once the test was completed, the data was taken from the output file, the mean reaction time was calculated excluding the first and last values. After both the subjects from each group completed the visual test, they undertook the auditory reaction test. This was taken from the ‘testlabsounds’ file in the DirectRT program. In the testlabsounds test, the subjects were asked to press the ‘spacebar’ key, every time they heard a ‘beep’ sound. Once the test was completed, the data was taken from the output file, the mean reaction time was calculated excluding the first and last values. After both the members of a group completed the visual and auditory tests, the mean reaction time data for both the visual and auditory tests were entered in the laptop.

Results

TABLE 1 : Table showing mean VRT (ms) and ART (ms) in 32 subjects.

VRT (ms)	293.37± 13.01
ART (ms)	248.61 ±12.84

P Value <0.0001

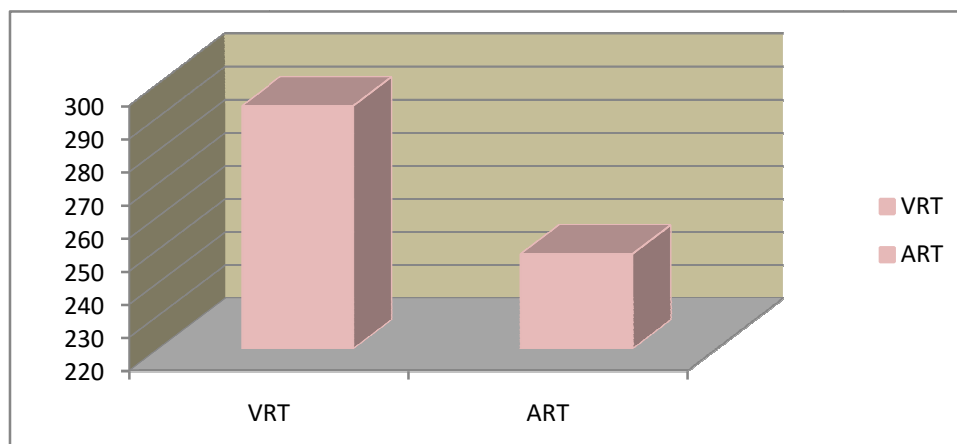


FIGURE 1. Graph showing faster simple reaction time for auditory stimulus compared to visual stimulus.

As the result shows, in **Table 1**, the mean visual reaction time is around 293.37 ± 13.01 milliseconds as compared to the mean auditory reaction time of around 248.61 ± 12.84 milliseconds. There was significant difference between ART and VRT. This confirms that the auditory reaction time is definitely faster compared to the visual reaction time. This finding is similar to the studies done by Pain & Hibbs, reference [1] and Thompson *et al.*, reference [2], which also show that auditory reaction time is faster than visual reaction time.

TABLE 2 : Visual reaction time (VRT) and auditory reaction time (ART) of male and Female subjects.

	MALE	FEMALE	P Value
VRT (<i>ms</i>)	285.59±12.53	301.15±13.49	>0.0001
ART (<i>ms</i>)	246.88±14.33	250.35±11.36	>0.0001

Values are mean±SEM.

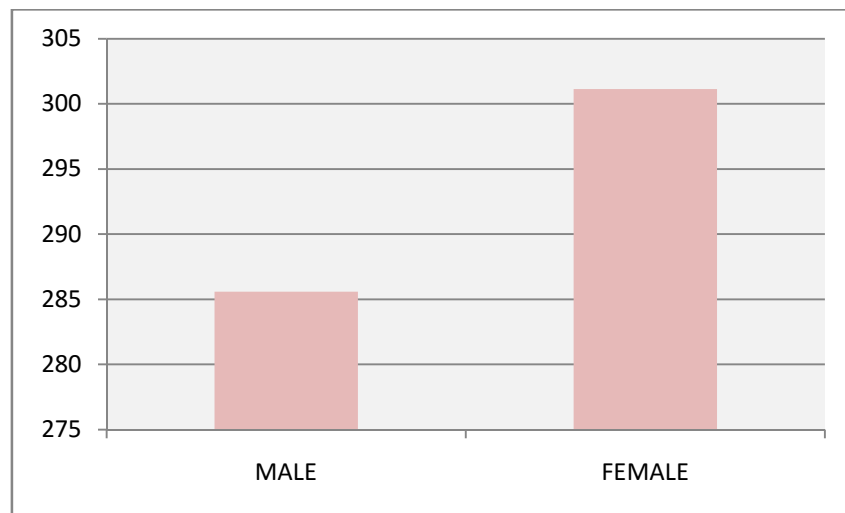


FIGURE 2: Graph showing faster simple reaction time for VRT in males as compared to females.

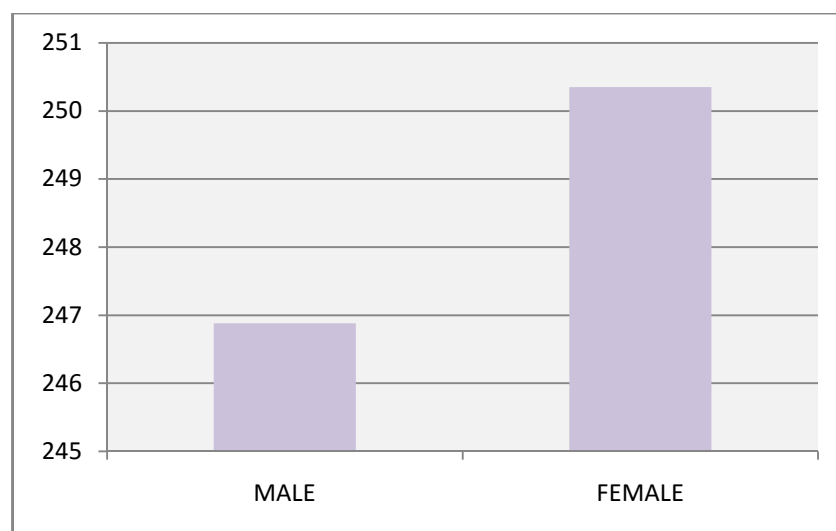


FIGURE 3: Graph showing faster simple reaction time for ART in males as compared to females

In this study, as seen in **Table 2**, it was also found that the male subjects had faster reaction times compared to the female subjects for both auditory as well as visual stimuli. There was no significant difference between male and the female subjects.

Discussion

This is the study first of its kind done in this region of Bihar. The results shows that the auditory reaction time is faster than the visual reaction time. And also males have faster reaction times when compared to females for both auditory as well as visual stimuli.

Reaction time is dependent on several factors like arrival of the stimulus at the sensory organ, conversion of the stimulus by the sensory organ to a neural signal, neural transmissions and processing, muscular activation, soft tissue compliance, and the selection of an external measurement parameter (Pain & Hibbs, reference [1]).

Researches by Kemp *et al.*, reference [7], show that an auditory stimulus takes only 8-10 milliseconds to reach the brain, but on the other hand, a visual stimulus takes 20-40 milliseconds. This implies that the faster the stimulus reaches the motor cortex, faster will be the reaction time to the stimulus. Therefore since the auditory stimulus reaches the cortex faster than the visual stimulus, the auditory reaction time is faster than the visual reaction time.

Reaction times are widely used to evaluate neuromuscular-physiological responses in sports. Studies by Pain & Hibbs, reference [1], have shown that the neuromuscular-physiological component of an auditory reaction time for sprint athletes can be around 85 milliseconds. Faster reaction times are significant for better performance of athletes. The faster the stimulus reaches the brain, the faster the signal is processed and the necessary responses are sent for the necessary motor reaction. Van den Berg *et al.*, reference [8], also found that fatigue due to sleep deprivation caused subjects to have slower reaction times. Studies by Ando *et al.*, reference [9], reported that reaction times reduced with repeated practice. Therefore reaction times to a particular stimulus can be made faster with repeated practice with a particular stimulus and with adequate rest in between stimuli.

In this study, as seen in **Table 2**, it was also found that the male subjects had faster reaction times compared to the female subjects for both auditory as well as visual stimuli. There was no significant difference between male and the female subjects. This finding is similar to

the research done by Dane *et al.*, reference [6]. The reason for this difference could be that it takes the same time for both the auditory and visual stimuli to reach the cortex but the time taken for the corresponding motor response and muscle contraction might differ. This was documented in the study done by Silverman, reference [10], that the motor response is faster in males when compared to females because they are comparatively stronger than females. This explains why males have faster simple reaction times for both auditory as well as visual stimuli.

Conclusion

From the above study it can be concluded that simple reaction time is faster for auditory stimuli compared to visual stimuli. Auditory stimuli has the fastest conduction time to the motor cortex. It has fast processing time in the auditory cortex. Therefore the auditory stimulus has faster reaction time and quick muscle contraction.

The above evidences suggest that speed and performance of an activity can be improved with faster reaction time to a stimulus. From the above findings of the study, faster reaction times can be achieved by providing repeated auditory stimuli and with adequate periods of rest between the stimuli.

The performance can be enhanced by:

- Selecting male individuals for jobs requiring high alertness and performance.
- Exposure to adequate auditory stimuli;
- Repeated exposure to stimuli by repeated practice;
- Adequate periods of rest between practices.

Funding: Nil, **Conflict of interest:** None initiated,
Permission from IRB: Yes

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How to cite this article?

Jayaswal AA. Comparison between auditory and visual simple reaction times and its relationship with gender in 1st year MBBS students of Jawaharlal Nehru Medical College, Bhagalpur, Bihar. *Int J Med Res Rev* 2016;4 (7):1228-1232.doi:10.17511/ijmrr.2016.i07.26.
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