

# A pilot study to compare auditory and visual reaction time in male and female young adults



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## ABSTRACT

**Background:** It was explained that there are very few studies that exist in the literature that assessed the reaction time in young adults. **Aims and Objectives:** The primary objective of the present study was to assess and compare the auditory and visual reaction time among male and female young adults. The secondary objective was to compare auditory and visual reaction time's right- and left-hand responses. **Materials and Methods:** A total of 120 male and female young adults were part of the study after obtaining informed consent. Auditory and visual reaction time was assessed using the RT apparatus manufactured by Anand Agencies, Pune. The instrument can assess visual reaction time for the green and red light and auditory reaction time for tone and click sounds of both right- and left-hand responses. **Results:** Age and weight were significantly different between males and females, whereas height was not significant. The auditory and visual reaction times were not significantly different between the male and female participants. **Conclusion:** The present study reveals that there is no significant difference between the auditory and visual reaction time among male and female young adults. There is a need for more detailed studies to testify to the results.

**Key words:** Reaction time; Young adults; Sensory system; Motor system

## INTRODUCTION

The speed with which an individual responds to a stimulus is called reaction time.<sup>1</sup> Reaction time is an excellent test to observe individuals' cognitive functions, because it involves the sensory and motor systems. It is a measure of processing speed. Hence, the assessment is for both sensory and motor systems.<sup>2</sup> There are various methods of reaction time assessments like simple reaction time, choice reaction time, and recognition reaction time.<sup>3</sup> Reaction time is a complex mechanism. When the stimulus is applied, it has to be perceived by the corresponding receptors and then transmit the information to the sensory system. Now, the sensory system sends impulses to the motor system and from the motor system, impulses pass through the spinal

cord to the corresponding muscles, and there will be a response. Although this much-complicated mechanism is involved, there are only a few milliseconds to complete the process. However, conditions like Parkinson's disease damage the brain and causes prolonged reaction time. Hence, assessment of reaction time helps for the early diagnosis of neuronal diseases. It was explained that there are very few studies exist in the literature that assessed the reaction time in young adults.<sup>4,5</sup> Hence, the present study was designed to assess the reaction time in males and females.

### Aims and objectives

The primary objective of the present study was to assess and compare the auditory and visual reaction time among male and female young adults. The secondary objective was

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to compare auditory and visual reaction time's right- and left-hand responses.

## MATERIALS AND METHODS

### Study design

The study was observational study.

### Study setting

The present study was conducted at KVG Medical College and Hospital and R.D.Gardi Medical College, Ujjain, Madhya Pradesh, India.

### Study participants

A total of 120 male and female young adults were part of the study after obtaining informed consent.

### Inclusion criteria

Healthy and willing participants of both genders within the age group of 18–24 years were included in the study.

### Sample size and sampling method

The sample size was calculated based on the study published earlier.<sup>23</sup> The confidence level was 95%, the margin of error was 10%, the population proportion was 50%, and the required sample size was 97. A total of 100- and 51<sup>st</sup>-year medical students were screened and out of 150, 100, and 20 were willing to participate in the study and meet the inclusion and exclusion criteria. A convenient sampling method was used to select the samples for the study.

### Assessment of reaction time

Reaction time was assessed in all the participants at 10 Am in the morning to overcome diurnal variations. Auditory and visual reaction time was assessed using the RT apparatus. This is called the research RT apparatus and is equipped to measure the reaction time of the right and left hands separately. It consists of two sides one is the examiner side other is the participant side. On the participant side, there are two keys for corresponding hands to respond. Furthermore, green and red lights and speakers to deliver a high pitch and low pitch sounds are present. There is a main switch to the machine on the examiner's side. Once the machine on the chronoscope shows to display. This can reset to zero using the reset switch. There is a switch to select which hand response, we need to assess. There are four switches for two auditory: High pitch and low pitch sounds and two visual that is a red and green light to deliver. For delivering, a stimulus initially resets the chronoscope to zero, and then, the subject is instructed on which hand to respond to and what is the stimuli. Then, the stimulus is delivered and once the subject responds, the reading on the chronoscope will be recorded (Figure 1).



**Figure 1:** Reaction time apparatus

### Ethical considerations

The Institutional Human Ethical Committee approved the study protocol.

### Statistical analysis

Data were analyzed using SPSS 20.0 version. A student t-test was applied to assess the significance of the difference between the groups. The probability value of  $<0.05$  was considered significant.

## RESULTS

Demographic data of the participants are presented in Table 1. Age and weight were significantly different between males and females, whereas height was not significant. The auditory and visual reaction times were not significantly different between the male and female participants (Tables 2 and 3). There was no significant difference in the right- and left-hand responses of reaction time among the males and females (Tables 2 and 3).

## DISCUSSION

Reaction time is a measure of how fast the nervous system works. It needs the coordination of both sensory and motor systems. It assesses the central and peripheral neuronal structures. Measurement of reaction time accounts for the estimation of cognitive functions in healthy individuals as well as bedside patients. However, the studies related to the assessment of reaction time among male and female young adults were sparse. Hence, this is a present study that observed the comparison of auditory and visual reaction times between males and females. The study also compared both right- and left-hand responses. It was found that there was no significant difference present between the right

**Table 1: Demographic data of the participants**

Parameter	Females (n=70)	Males (n=50)	P value
Age (years)	19±0.24	18±0.28	0.0079**
Height (cm)	160±5.02	172±7.78	0.1780
Weight (kg)	62±2.27	74±3.11	0.0018**

Data were presented as mean and SEM. \*\*P<0.01 is significant

**Table 2: Comparison of visual reaction time of the right- and left-hand responses for red and green light among the males and females**

Parameter	Females (n=70)	Males (n=50)	P value
VRT green right response	0.3254±0.0253	0.34±0.07379	0.8562
VRT green left response	0.3134±0.02044	0.3572±0.05279	0.4613
VRT red right response	0.3188±0.01757	0.2848±0.02089	0.2482
VRT red left response	0.3758±0.05574	0.42060±0.02025	0.4716

Data were presented as mean and SEM. VRT: Visual reaction time

**Table 3: Comparison of auditory reaction time of the right and left-hand responses for high pitch and low pitch sounds among males and females**

Parameter	Females (n=70)	Males (n=50)	P value
ART high pitch sound right response	0.26983±0.01333	0.25480±0.02363	0.5762
ART high pitch sound left response	0.25133±0.01355	0.24900±0.02706	0.9369
ART low pitch right response	0.38917±0.02844	0.33080±0.04337	0.2749
ART low pitch left response	0.28750±0.02516	0.31840±0.05692	0.6097

Data were presented as mean and SEM. ART: Auditory reaction time

and left-hand responses of auditory and visual reaction times among male and female participants. Earlier studies reported that there is a significant difference between male and female participants.<sup>2</sup> It was reported that ART is faster than VRT.<sup>6,7</sup> Our study agrees with this study as the same results were observed in our study as well. The reason was explained as faster processing in the auditory cortex compared to the visual cortex.<sup>8</sup> In contrast, another study reported that visual reaction time was faster than auditory reaction time.<sup>9</sup>

Earlier studies reported that males' reaction time was faster than females.<sup>10-12</sup> The faster response in males is explained due to the faster motor response. However, the muscle contraction time is the same for males and females.<sup>13,14</sup> Earlier studies removed the confounding factor, especially the sedentary lifestyle, and compared males and females<sup>15</sup> The present study does not remove the confounding factor. This may be one reason why we have not observed

the difference between the auditory and visual reaction times of the male and female participants. Another study compared the reaction time of hands and feet and reported a significantly faster reaction time on the dominant side. The present study does not observe a significant difference between the right- and left-hand responses. Another reason explained for the gender-based difference in the reaction time is that the gray matter volume of a male's right anterior hippocampus, which acquires or encodes new visuospatial information, is larger than that of a female.<sup>16</sup> In contrast, some studies showed no difference in the reaction time between males and females.<sup>17,18</sup> Another study reported that females tend to choose incorrect responses during the task.<sup>19</sup> Interestingly, another study explained that the visual reaction time does not change with the time of the day.<sup>20,21</sup> Another study reported that the reaction time was not significantly different in the age groups of 15–18 years and 20–30 years.<sup>22</sup> Lalitha et al., reported that females have higher body mass index and longer reaction times than males.<sup>23</sup> These contrasting findings explain that the reaction time among males and females is not well-understood to date. Further, variations are possible due to different factors affecting age, gender, individual intelligence, fatigue, exercise, training, etc.<sup>24</sup> There is a strong need for studies in this area with higher sample size.

#### Limitations of the study

The sample size of the study was small; hence, results cannot be generalized.

## CONCLUSION

The current study reveals that there is no significant difference between the auditory and visual reaction time for the right- and left-hand responses. There is a need for more detailed studies to testify to the results.

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