

Immediate Effect of Exercise on Auditory and Visual Reaction Time in Medical Students

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Abstract

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Introduction: Reaction time (RT) denotes time taken by an individual to react to external stimulus. RT plays a very important role in our lives as its practical implications may be of great consequences. Fast RTs can give rewards (e.g. in sports), whereas slow RT can lead to grave consequences (e.g. driving and road safety matters). Factors that can affect the human auditory and visual reaction time include age, gender, left or right hand, practice, fatigue, exercise etc. The present study was conducted, which was aiming to find out immediate effect of exercise on auditory and visual reaction time in medical students. *Material and Methods:* For determination of VRT (Visual Reaction Time) and ART (Auditory Reaction Time) we have used reaction time apparatus designed by Anand agency pune. VRT and ART were determined in 120 healthy medical students in the age group of 17 to 25 years before exercise. All the subjects were asked to perform 5 minute warm up followed by 15-20 minutes exercise on the stationary bicycle (Body Gym Stamina Air Bike) at the speed of less than 5 mph. Data was analyzed by unpaired "t" test. We found both ART and VRT was significantly decreased immediately after physical exercise ($p < 0.05$). *Conclusion:* Thus our study showed both VRT and ART was significantly decreased in medical students immediately after physical exercise on stationary bicycle.

Keywords: Auditory Reaction Time; Physical Exercise; Reaction Time; Visual Reaction Time.

Introduction

Reaction time (RT) denotes time taken by an individual to react to external stimulus. RT is defined as the time interval between the onset of stimulus and appearance of appropriate voluntary response by the subject [1,2]. Reaction time is decisive for our everyday lives and needs intact sensory and motor system [3]. Reaction time represents the level of neuromuscular coordination in which the body through different physical, chemical and mechanical processes decodes visual or auditory stimuli. Reaction time is one of the simplest methods for assessing the sensory and motor performance of an individual. The ability of animal to cope up with environmental changes for their survival and existence depends

upon the responses given by animal. Quickness of response depends on the integrity of cell communication, sensory perception, central processing and motor response [4].

Factors that can affect the human RT include age, gender, left or right hand, central versus peripheral vision, practice, fatigue, intelligence of the subject, fasting, exercise etc. [5-7]. Exercise is claimed to have beneficial effects on various body functions including performance of central nervous system. Audio-visual reaction time is the speed with which an individual can respond to an auditory stimulus and visual stimulus respectively. Hence, present study was conducted, which was aimed to find out immediate effect of exercise on auditory and visual reaction time in medical students.

There are three basic types of reaction time experiments [8]

1. *Simple reaction time experiments*: there is one stimulus and one response. Thus in simple reaction time task, only one stimulus is presented which commands a single response. (e.g. spot the dot and react to sound; both measure simple reaction time).
2. *Choice reaction time (Disjunctive reaction time) experiments*: involve presentation of multiple stimuli each calling for a specific response. Thus in choice reaction time task several (minimum two) stimuli are presented and the subject is required to respond correspondingly (e.g. pressing a key in response to the appearance of a particular light on a screen).
3. *Associative reaction time experiments*: involve responding in the form of verbal association to a stimulus which can be either verbal or pictorial.

Aim

To find out immediate effect of exercise on VRT (Visual reaction Time) and ART (Auditory Reaction Time) in the medical students

Materials and Methods

After obtaining approval from research and ethical committee, DVVPPF's medical college a total 120 medical (80 male and 40 female) students of 2016 batch were selected and written informed consent was taken from all the participants. The present observational study was conducted in the research lab, Department of Physiology, Vikhe Patil Medical College, between 3.00pm and 5.00pm for period of 6 months (April 2016-September 2016).

Inclusion Criteria

The present study was conducted in 120 medical students in age group of 17-25 yrs both male and females. All were physically and mentally healthy students.

Exclusion Criteria

1. History of smoking, alcoholism
2. Those having any history of hearing disorders, visual disorders and color blindness,
3. History of any medications affecting cognitive performance was excluded from the study.

4. Those having any major illness in the present or past
5. History of any neurological abnormality affecting sensory and motor function

Visual Reaction time and auditory reaction time were recorded by using audiovisual Reaction time apparatus designed by Anand agencies Pune in the year 2004 [9]. It works on 230 volts AC. The instrument is specially designed to measure reaction time in seconds. It has Inbuilt digital chronoscope present on examiners side which measures the reaction time in seconds [9]. All the subjects were thoroughly acquainted with the apparatus. All tests were done in quiet room at room temperature of 26-32 degree Celsius. VRT and ART were measured in all participants before physical exercise.

Then all the subjects were asked to perform warm up for 5 minutes followed for stationary bicycle exercise for 15-20 minutes at the speed of less than 5 mph [10]. We have used Body Gym Stamina Air Bike bicycle which was designed by RK Fitness PVT. LTD [11]. After physical exercise VRT and ART were recorded again.

Auditory reaction time - The auditory stimulus was provided in the form of high (beep tone) frequency sound. After connecting the instrument to mains, subject was asked to sit on chair in front of the instrument. He/she was asked to press the response switch using the thumb as soon as, he/she hears the tone. Like wise 3 readings were taken before and also after physical exercise and average of these three readings was taken as the subject's best reading.

Visual reaction time- The visual stimulus was provided in the form of green and red color light. Both visual stimuli were given separately. Subject was asked to press response switch as soon as the red or green color light blinks. 3 readings were taken and average of these 3 readings was taken as the subject's best reading.

The data was statistically analyzed by using student unpaired 't' test.

Results

Table 1 show that visual reaction time for green color light was significantly faster after exercise (0.191 ± 0.031) than before exercise (0.201 ± 0.035)

Table 2 show that visual reaction time for red color light was significantly faster after exercise (0.176 ± 0.027) than before exercise (0.197 ± 0.034)

Table 3 show that auditory reaction time in was significantly faster after exercise (0.195±0.037) than before exercise (0.206±0.041)

Figure 1 showing faster VRT and ART after exercise as compared to before exercise

Table 1: Comparison of visual (green color light) reaction time in seconds before and after exercise

	N	Mean ± SD	'p' value
Before exercise	120	0.201 ± 0.035	0.02*
After exercise	120	0.191 ± 0.031	

* p<0.05 statistically significant ** p<0.001 statistically highly significant

Table 2: Comparison of visual reaction (red color light) time in seconds before and after exercise

	N	Mean ± SD	'p' value
Before exercise	120	0.197± 0.034	0.0012*
After exercise	120	0.176 ± 0.027	

Table 3: Comparison of auditory reaction time in seconds before and after exercise

	N	Mean ± SD	'p' value
Before Exercise	120	0.206 ± 0.041	0.0301*
After Exercise	120	0.195 ± 0.037	

* p<0.05 statistically significant ** p<0.001 statistically highly significant

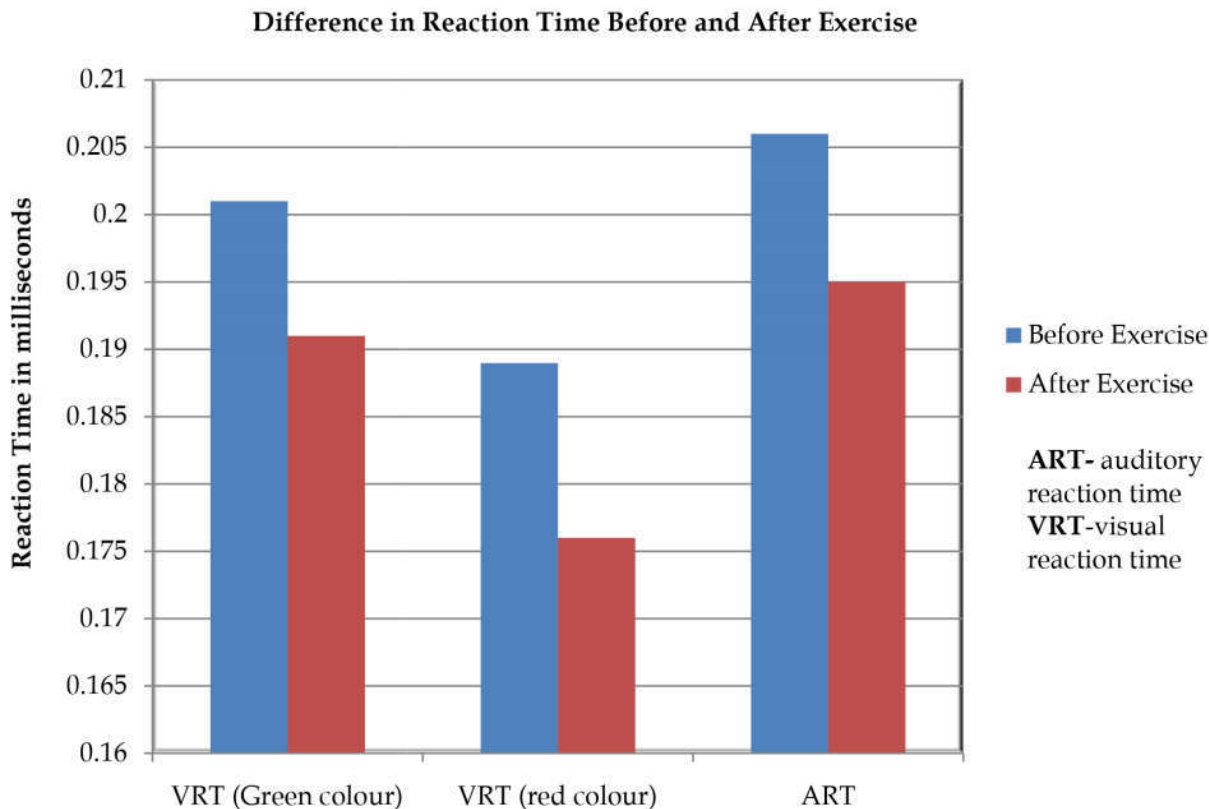


Fig. 1: Comparison of ART and VRT before and after exercise in (n=120) medical students

Discussion

The present study was aimed to find out immediate effect of exercise on visual reaction time (VRT) and auditory reaction time (ART) in medical students. Visual reaction time (red and green color light) and Auditory reaction time were recorded in 120 healthy medical students (80 male and 40 female) before and immediately after exercise. In the present study we found that both VRT and ART were significantly faster immediately after exercise. Table 1, Table 2 and Figure 1 shows faster visual reaction time for green and red color light after exercise ($p < 0.05$). Table 3 and Graph 1 shows auditory reaction time was faster after exercise ($p < 0.05$).

Reaction time is dependant on several factors like arrival of stimulus at the sensory organ to neural signal, neural transmission, processing and muscular activation. Malhotra V et al showed that reaction time was faster immediately after exercise. [12] Fastest reaction time was observed when subjects were exercising sufficiently to produce a heart rate of 115 beats per minute [13]. Increased heart rate leads to increase in cortical blood flow which in turn causes increased supply of nutrients like glucose and oxygen to brain thereby enhancing cognitive function of brain [14]. Exercise also increases cognitive function due to great state of arousal [15].

During exercise, exchange of oxygen from blood to the tissue is more rapid which in turn leads to increased transmission of impulse along nerve fibres [16]. Another study reported that reaction time was decreased after 30 minute exercise irrespective of age and gender [17].

Following are the probable mechanisms that can explain why there is decrease in reaction time immediately after exercise [12,14,18,19].

- a. After exercise, cortical blood flow increases leading to increased cognitive function
- b. Alteration in the levels of neurotransmitter such as serotonin, norepinephrine, dopamine
- c. Increasing oxidative enzyme activity which normally protects CNS from oxidative stress

Conclusion

There was decrease in reaction time following exercise in medical students which suggests that there was an improvement in the cognitive functions after exercise. Thus it is evident that even 10 minute of exercise can bring improvement in the

cognitive function. We conclude that reaction time (ART and VRT) were faster immediately after exercise. It may be valuable for personnel like soldiers, fire fighters, miners where a person is being asked to make decisions while performing physical works.

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Appendixes

RT- Reaction Time

ART- Auditory Reaction Time

VRT- Visual Reaction Time

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