

The Influence of Caffeine on the Visual and Auditory Reaction Time in Medical Students

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Abstract : Reaction time is the measure of the function of sensory motor association. and performance of an individual . Reaction time is the time required for the nervous system to receive, integrate the incoming sensory information and cause the body to respond.. Caffeine belong to Xanthene group of drugs. Caffeine is a central nervous system stimulant that reduces fatigue and drowsiness, at normal doses, caffeine has variable effects on learning and memory. The aim of the study was to determine visual reaction time (VRT) for green (G) versus red (R) color light and auditory reaction time (ART) in young adults after the administration of known amount of caffeine. A cross-sectional study was carried out in 40 male medical students in the age group of 18-20 years from Sri Deva raja Urs Medical College in the Department of Physiology. The reaction time was measured by using an indigenously designed portable apparatus called as the reaction time apparatus. The auditory reaction time was found to be less than visual reaction time, Many researchers have confirmed that reaction to sound is faster than light with mean auditory reaction time being 140-160 ms and visual reaction time being 180-200ms. Hence can be concluded that reaction time for sound is less than light and also that caffeine is a strong central nervous system stimulant.

Keywords : , Visual reaction time, auditory reaction time, caeffine, reaction time apparatus.

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I. INTRODUCTION

Many of our everyday actions are taken for granted like blinking of our eyes to picking a pencil to driving a car. Most actions except a simple reflex involve a large amount of brain activity. Reaction time has been a favorite subject of experimental psychologists since the middle of the nineteenth century. It is a physical skill 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 [1]

It is the measure of the function of sensory motor association. [2] and performance of an individual [3]. It has physiological significance and is a simple and non-invasive test for peripheral as well as central neural structures [4]. It gives an idea about the integrity and processing ability of the central nervous system. Reaction time is the time required for the nervous system to receive, integrate the incoming sensory information and cause the body to respond. The pioneer study of reaction time was done by Donders in(1868) [5] 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 a particular stimulus.

The discovery of coffee is been to have occurred in Ethiopia where according to legend, a shepherd observed a change in the behavior of his goats after they had eaten a particular type of plant. Then the shepherd ate some of the beans of the plant which has since been named coffee Arabica and felt its stimulating effect. He reported these effects to others. The use of coffee spread to Arabia around 1200A.D

Caffeine belong to Xanthene group of drugs. It is an odorless white powdery alkaloid and completely dissolves in water when coffee is made. A Cup of coffee 150ml contains about 100-120mg of caffeine when ingested in the form of coffee it is absorbed into the blood stream primarily from the small intestine. The absorption is initially slow and is equally distributed through the tissue of the body including brain. Caffeine is a

Stimulant that reduces fatigue and drowsiness, at normal doses, caffeine has variable effects on learning and memory. It generally improves reaction time, wakefulness, concentration, and motor coordination.[6,7]

II. Objectives

The present study seeks to determine visual reaction time (VRT) for green (G) versus red (R) color light and auditory reaction time (ART) in young adults after the administration of known amount of caffeine.

III. Materials And Methods

After the approval from institutional ethical committee. A cross-sectional study was carried out in 40 male medical students in the age group of 18-20 years from Sri Devaraja Urs Medical College in the Department of Physiology. The subjects were explained about the experiment protocol and their consent was taken.

Visual reaction time and auditory reaction time was conducted in a quiet and secluded room between 11am to 1pm. The reaction time was measured by using an indigenously designed portable apparatus called as the reaction time apparatus. Reaction timer instrument has two components (A & B) connected to each other. (A) has a start button and it is handled by the examiner only. (B) has a stop button which will be handled by the subject alone, it has a small Red light and Green light used as a stimulus to measure visual reaction time (VRT) and head phone which receives the high pitch sound to measure auditory reaction time (ART). Instrument was kept on table & subject was made to sit down comfortably on chair. Practice was taken from each subject until they have understood and performed the task as required. Subject was asked to press & immediately release the switch with the thumb of right-hand as soon as he saw the glow of red light and green light for visual reaction time or hearing sound for the auditory reaction time. (FIG.1)

The base line reaction time reading of the reaction time for both VRT for red and green light and ART was performed by giving the subject about 10 trials each. Soon after that they were given a cup of coffee with the known amount of caffeine. (100-200mg of caffeine per 100 ml of coffee) 10 min later the reaction time for both ART and VRT was recorded by the above said manner and the mean of the two sets of reading were used for comparison. The recorded values were expressed as mean \pm standard deviation. The different parameters were compared using student 't' test. The statistical analysis was done by paired t-test and calculated by SPSS version 19.

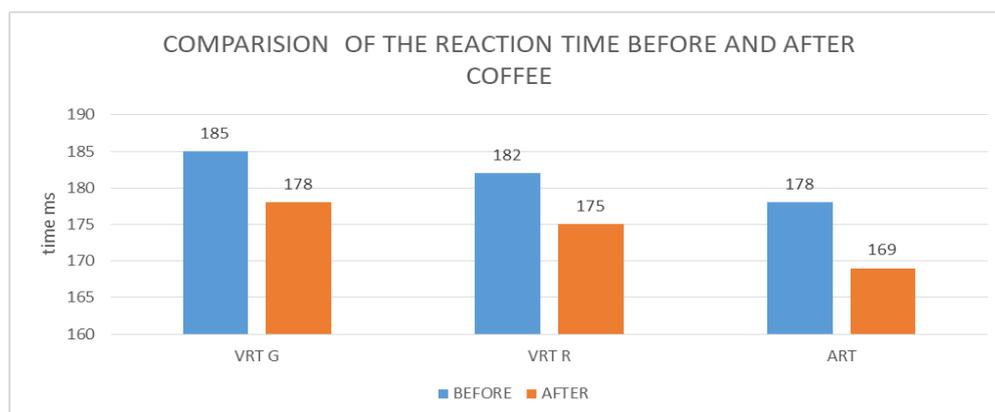
IV. Results

Data was tabulated statistically treated and expressed as mean \pm standard deviation

Table 1. Comparison of the reaction time before and after coffee in milliseconds.(ms)

Reaction Time	BEFORE	AFTER	P Value
VRT(G)Ms	185.3 \pm 19.5	178.5 \pm 19.1	P< 0.05
VRT(R)Ms	182.0 \pm 17.5	175.3 \pm 16.6	P< 0.05
Artms	178.3 \pm 24.3	169.3 \pm 23.2	P< 0.05

Table 1 shows a significant decrease in mean values of visual reaction time for the green light and red light and for the sound which was comparison of reaction time before and after the coffee in milliseconds (p<0.05) found to be significant.



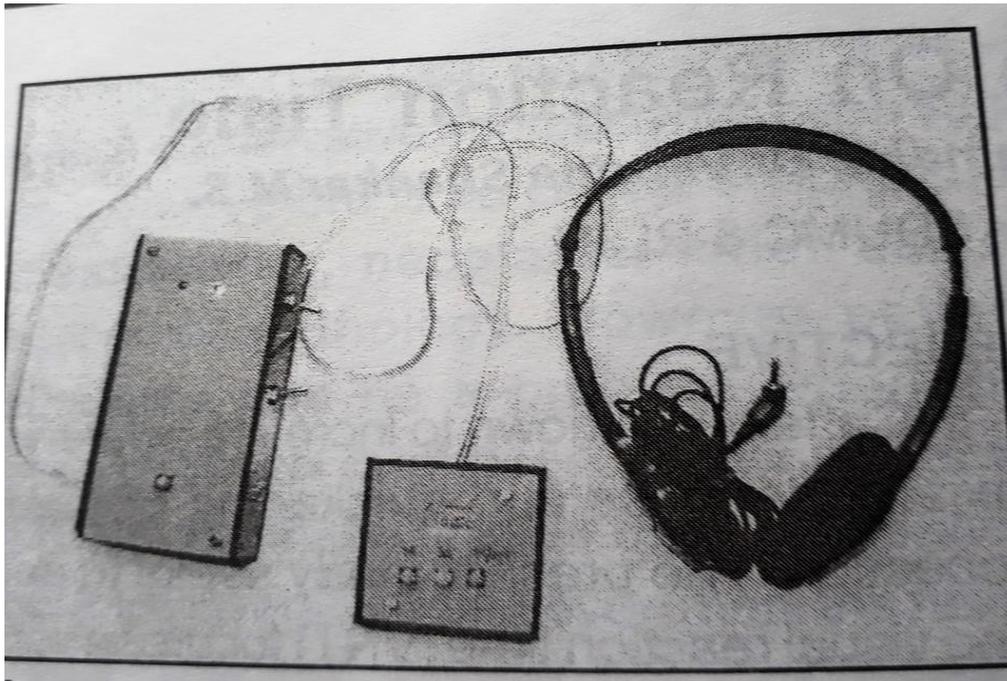


Fig 1 REACTION TIME APPARATUS

V. Discussion

The auditory reaction time is found to be less than visual reaction time, which is similar to Thompson experiment who 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. [8]

Pain and Hibbs, in their research showed that simple auditory reaction time has the fastest reaction time for any given stimulus [9]

From our result we found that the visual reaction time for red light was found to be lesser than green light This can be explained on the basis of trichromatic theory of colour vision. When Tomita and co -worker illuminated the retina with microelectrode penetration of single cone they found that 16% of the units peaked in blue spectrum, 10% in the green and 74% in the red.[10]

The reaction time in the auditory is lesser visual reaction time. Many researchers have confirmed that reaction to sound is faster than light with mean auditory reaction time being 140-160 ms and visual reaction time being 180-200ms. (Galton 1899, Wood Worth and schlosberg 1954 Fieandt et al Welford 1980.) This is because an auditory stimulus takes only 8-10 sec to reach the brain (Kemp et a 1973) [11]

but visual stimulus takes 20-40 msec to reach the brain. Therefore, since the auditory stimulus reaches the cortex faster than the visual stimulus, the ART is faster than the VRT. Shelton and Kumar[12] also concluded that simple RT is faster for auditory stimuli compared with visual stimuli and auditory stimuli has the fastest conduction time to the motor cortex along with fast processing time in the auditory cortex.

Factors that can affect the average human RT include age, sex, left or right hand, central versus peripheral vision, practice, fatigue, fasting, breathing cycle, personality types, exercise, and intelligence of the subject [13]

From our results it is seen that the reaction time was reduced both for the visual and auditory stimulus after coffee which is explained on the following basis caffeine is a central nervous system stimulant. In moderate doses caffeine can increase alertness reduce fine motor coordination and cause insomnia. The three main mechanism of action of caffeine on the Central nervous system has been described. It is known to improve physical performance and mental alertness. This is because of the neuro hormonal influence of caffeine which helps in mobilization of the intracellular calcium and it inhibits an enzyme called phosphodiesterase which breaks cAMP and increase cellular activity resulting in generalized stimulation. The only likely mechanism of action of methylxanthine is antagonism at the level of adenosine receptors.[14] Caffeine increases metabolism throughout the brain but at the same time decreases the blood flow including a relative brain hypo -perfusion. It activates noradrenaline neurons and seems to affect the local release of dopamine.

Many of the actions of the caffeine may be related to the action of methyl xanthine on serotonin neurons. Caffeine acts on the memory and f learning behavior actions also. It is evenly distributed throughout the tissue of the body including brain and placenta. Inactivation is accomplished by liver enzymes before excretion by the kidney. About 10% of the caffeine ingested in excreted unchanged.[15]

VI. Conclusion

It can be concluded from our study that vrt and art were significantly reduced after the consumption of caffeine $p < 0.05$, and we also studied that the visual reaction time for the red light was less than the green light. Hence can be concluded that reaction time for sound is less than light and also that caffeine is a strong central nervous system stimulant.

Reverences

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