



**ORIGINAL RESEARCH PAPER**

**Physiology**

**INFLUENCE OF COLOUR DIFFERENCE ON VISUAL REACTION TIMES IN YOUNG ADULTS**

**KEY WORDS:** visual reaction time, colour of the stimulus

**Dr Shweta Sehgal\***

Department of Physiology, Army College of Medical Sciences, India  
\*Corresponding Author

**Dr Rahul Kapoor**

Department of Plastic surgery, Fortis Memorial Research institute, India

**ABSTRACT**

Reaction time is defined as an interval of time between the application of stimulus and the initiation of appropriate voluntary response as the subject has been instructed to respond as rapidly as possible. Simple reaction time is used to evaluate the processing speed and the co-ordination between the sensory and motor systems. Reaction time is influenced by various factors. Therefore, the effect of colour stimulus in modulating the reaction time among young Indian males has been investigated in this study. A total of 60 healthy volunteers (young males) of age group 19-27 years were included in the study. The subjects were presented with two visual stimuli viz. ; red and green light by using an audio visual reaction time apparatus. Using paired t-test for comparison of visual reaction time between red and green colour in young males, it was observed that the response latency for red colour was significantly less compared to green colour ( $P < 0.05$ ). From the present study, it could be suggested that the colour stimulus has an impact in modulating the visual reaction time.

**INTRODUCTION**

Reaction time is a reliable indicator of the speed of processing of sensory stimulus and its execution in the form of motor response by central nervous system (1). The measure of simple reaction time has been used to evaluate the processing speed of CNS and the co-ordination between the sensory and motor systems. As the reaction time is influenced by different factors; the impact of colour of objects in modulating the reaction time has been investigated in this study.

Reaction time has been defined as the time interval between the application of a stimulus and the response by the subject (2). It is an indirect index of the processing ability of CNS and simple means of determining sensory motor association and performance of an individual (3). Reaction time can be used to detect the level of arousal of CNS, to determine sensorimotor performances (4), to measure the speed of decision making and response selection and also for assessing the aspects of the planning and execution of voluntary movement(5,6,7).

Visual reaction time (VRT) is a physical skill closely related to human performance. It represents the level of neuro-muscular coordination in which the body, through different physical, chemical and mechanical processes decodes visual stimuli which travel via afferent pathways and reach the brain as sensory stimuli (8,9). Simple VRT can be determined when an individual is asked to press a button as soon as a light appears (10,11). Study done by Thompson et al., has documented that the mean reaction time to detect the visual stimuli is approximately 180-200ms(12).

Various factors affect VRT such as stimulus, age, gender and fatigue. Further it has been reported that visual reaction time with red colour elicits a faster response when compared to green (13). On contrary other study shows, reaction time for green colour was shorter (14). In view of conflicting reports about the VRT in response to red and green, in this study the effect of VRT with respect to green and red light stimuli was assessed.

**Material and methods**

The present study was conducted in the Department of Physiology, Career Institute of Medical Sciences & Hospital, Lucknow, after obtaining the ethical clearance from Institutional Ethics Committee. 60 young healthy male volunteers of age group (19-27 years) were recruited. All the subjects included in the study were healthy, nonalcoholic, nonsmoking and had clinically normal vision. Informed consent was taken from all the subjects. Reaction time experiment was done in the morning, between 10 a.m. to 12 noon. After noting the relevant history and through clinical examination each participant was explained about the study protocol and sufficient trials were given for proper understanding.

After demonstrating the procedure, subjects were asked to

respond to visual stimuli by pressing the response key with the index finger of their dominant hand and three consecutive readings of stimulus were recorded, using an audio VRT apparatus. The interval between the stimuli was randomly varied from 2 to 5 seconds. The least reading of three was taken as the value for VRT.

**Statistical analysis of data**

Data were expressed as mean  $\pm$  SD. Results from the comparison of VRT between green and red colour were analyzed by using Student's paired t-test. SPSS version 13 was used for statistical analysis of data and a  $P > 0.05$  was considered significant.

**Results**

Average values of simple VRT in males are  $0.109 \pm 0.086$  s for red colour and  $0.250 \pm 0.185$  s for green colour. (Table-1)

**Discussion**

Reaction is a purposeful voluntary response to an external stimulus. There is certain time period between application of external stimulus and appropriate motor response to the stimulus called the reaction time. Reaction time is defined as interval of time between presentation of stimulus and appearance of appropriate voluntary response in a subject. It is usually expressed in milliseconds. It reflects the speed of the flow of neurophysiological, cognitive, and information processes which are created by the action of stimulus on the person's sensory system. The receipt of information (visual or auditory), its processing, decision making, and giving the response or execution of the motor act are the processes which follow one another and make what we call the reaction time (15,16).

Singer et al., defined reaction time as being composed of four stages, namely: The start of eye movements, eye movement time, decision time and muscle contraction time. In the present study, as Table-1 depicts, VRT for red colour stimuli is significantly less compared with green color stimuli among young males aged 18-28 years. This can be explained on the basis of relative number of cones activated in response to a particular color of light on the basis of trichromatic theory of color vision, which shows that sensation of any given color depends on relative frequency of impulses being sent from each of the cone systems. It has been reported that when the retina was illuminated with microelectrode penetration of single cones, 16% of the units peak in blue spectrum, 10% in the green and 74% in the red. Thus, maximum number of cones are activated for red color, followed by blue and least response was for green colour (17,18). Our observations are consistent with the previous report (14,17).

**Conclusion**

The VRT for red colour stimuli was significantly less compared to green colour stimuli, which can be explained on the basis of trichromatic theory. Thus, from the present study it can be

concluded that there is an impact of colour of stimulus in modulating VRT.

**Table-I Comparison of visual reaction time for red colour versus green colour among young males**

Young males (19-27 years)	Parameters	Mean±SD	P
	VRT(Red colour)	0.109±0.086	0.010
	VRT(Green colour)	0.250±0.185	

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