

RESEARCH ARTICLE

# COMPARATIVE STUDY OF AUDIOVISUAL REACTION TIME IN PATIENTS WITH TYPE 2 DIABETES MELLITUS AND IN NORMAL SUBJECTS

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**Key Words**

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**Background:** Reaction time, which is a reliable indicator of attention and fine motor skills, was found to be slowed in diabetes mellitus. It is often overlooked and underestimated element in medical fitness test for professionals highly dependent on motor skills, such as drivers, pilots, and doctors. Many of them may be diabetic. Limited reports are available from India on the effect of type 2 diabetes mellitus on reaction time. Thus, this study was undertaken to determine the effect of type 2 diabetes mellitus on reaction time.

**Aims & Objective:** To compare audiovisual reaction time of patients with type 2 diabetes mellitus to that of normal subjects.

**Materials and Methods:** We measured audiovisual reaction times of 50 patients with type 2 diabetes mellitus and compared them with those of 50 healthy, age-matched subjects that formed control group.

**Results:** Audiovisual reaction times of patients with type 2 diabetes mellitus were significantly higher as compared to those of normal subjects (control group).

**Conclusion:** Audiovisual reaction time may prove a simple and valuable method for assessing severity of neurological derangement and effectiveness of treatment in type 2 diabetes mellitus.

## INTRODUCTION

In India there are about 40.9 million patients with diabetes mellitus, and this number is expected to increase to about 69.9 million by the year 2025.<sup>[1]</sup> The number of patients with diabetes mellitus is increasing constantly worldwide. With the increase in the cases of diabetes, complications associated with it are also likely to increase.<sup>[2]</sup> Visual reaction time, which is a reliable indicator of attention and fine motor skills, was found to be slowed at altered glucose levels.<sup>[3]</sup> Autonomic dysfunction in patients with diabetes mellitus was reported by many researchers.<sup>[4-8]</sup> It is usually associated with poor prognosis.<sup>[9]</sup> Reaction time has physiological significance and is a simple noninvasive test for peripheral as well as central nervous system. Thus, reaction time measurement might be useful in studying the neurological deficit in patients with diabetes mellitus. Reaction time is often overlooked and underestimated element in medical fitness test for professionals who are highly dependent on motor skills, such as drivers, pilots, and doctors. Many of them may be diabetic. Limited reports are available from India on the effect of type 2 diabetes mellitus on

reaction time. So, this study was undertaken to study the effect of type 2 diabetes mellitus on reaction time, and to compare auditory and visual reaction times of patients with type 2 diabetes with those of controls.

## MATERIALS AND METHODS

This was a comparative case-control study carried out at Department of Physiology of Dr. Shankarrao Chavan Government Medical College, Nanded, Maharashtra, India. The study group comprised 50 patients (28 men and 22 women; age group 31-65 years) with type 2 diabetes mellitus (>10 years duration) from the Medicine OPD of Dr. Shankarrao Chavan Government Medical College, Nanded. Patients with a history of reduced sensory as well as pain perception in limbs were excluded from the study. The controls were 50 age-matched healthy employees of the same institute. Patients with diabetes mellitus (the study group) and healthy controls (the control group) in the study were nonalcoholic and nonsmokers with normal vision. They were having neither any psychiatric disease affecting their psychomotor abilities nor any pathology or injury in the upper limbs. Any of these conditions could be responsible for affecting reaction

time estimate and could be a confounding factor. The subjects were informed about nature of study and informed consent was taken. Institutional ethical committee clearance was also taken.

Auditory and visual reaction time was measured using an audiovisual reaction time apparatus supplied by Medicaid Systems. The instrument had a display that shows reaction time in seconds with accuracy of 0.001 second. It provides auditory stimulus by a beep sound and visual stimulus by glowing red, green, and yellow lights. Patients respond to a stimulus by pressing response switch with their dominant index finger as soon as they perceive stimulus. Multiple practice trials were performed till we were satisfied that the subjects understood the procedure. After sufficient practice, three readings were taken for auditory and visual reaction time each, and mean of the three readings was recorded in the subject's profile. Statistical significance was determined using Student's *t*-test on Graph pad Prism version 6 software.

## RESULTS

Auditory reaction time was found to be significantly more in the study group ( $0.1955 \pm 0.0081$ ) than in the control group ( $0.1653 \pm 0.0064$ ). Visual reaction time for response to red, green, and yellow lights of the study group was found to be significantly higher than of the control group.

**Table 1:** Comparison of audiovisual reaction time in control and study group

Reaction time (seconds)	Control Group (n = 50)	Study Group (n = 50)	p-Value	Significance
Audio reaction time	$0.1653 \pm 0.0064$	$0.1955 \pm 0.0081$	<0.05	Significant
Visual reaction time for red color	$0.1985 \pm 0.0624$	$0.2304 \pm 0.0568$	<0.05	Significant
Visual reaction time for green color	$0.2081 \pm 0.0596$	$0.2354 \pm 0.0594$	<0.05	Significant
Visual reaction time for yellow color	$0.2107 \pm 0.0680$	$0.2428 \pm 0.0821$	<0.05	Significant

## DISCUSSION

This study revealed that audiovisual reaction time was prolonged in patients with type 2 diabetes mellitus when compared to healthy control group, as shown in Table 1. Our study findings were consistent with the earlier reports.<sup>[10,11]</sup> The axonal degeneration of both myelinated and unmyelinated fibers, axon shrinkage, axonal fragmentation, and thickening of basement membrane and microthrombi are responsible for delayed motor nerve conduction velocity, and hence the reaction time is delayed in type 2 diabetes mellitus group.<sup>[12]</sup> Peripheral neuropathy is often seen in

patients with diabetes mellitus. However, there is also additional slowing in processing of signals by the central nervous system in type 2 diabetes mellitus.<sup>[13]</sup> This can also lead to prolongation of whole-body reaction time. Clinical significance of such subtle alteration is speculative. Probably such alterations might prove dangerous in subjects required to take instantaneous decisions, such as drivers, pilots, and doctors.

## CONCLUSION

Reaction time may prove a simple and valuable method for assessing severity of neurological derangement and effectiveness of treatment in type 2 diabetes mellitus. We further suggest audiovisual reaction time should be included in fitness test for professionals (such as drivers, pilots, and doctors) who are patients of type 2 diabetes mellitus.

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