

## A COMPARATIVE STUDY OF AUDITORY AND VISUAL REACTION TIMES IN TYPE II DIABETIC AND NON-DIABETIC INDIVIDUALS

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### ABSTRACT

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#### BACKGROUND

Diabetes mellitus over a period produces autonomic dysfunction. It is usually associated with poor prognosis. Reaction time is a simple noninvasive test for peripheral as well as central nervous system. Neurological deficit in patients with diabetes mellitus can be diagnosed by measurement of reaction time before it is clinically evident. Few studies have been done 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 auditory and visual reaction time.

#### MATERIALS AND METHODS

25 patients with type 2 diabetes mellitus and 25 healthy, age-matched control group were enrolled based on detailed questionnaire and informed consent was taken from all the subjects. The mean age of type 2 diabetic subjects was 48.8 years and that of control was 48 years. The subjects with type 2 diabetes were on oral medication and of more than 5 years duration. Subjects with history of alcoholism, smoking, history of hypertension, subjects on insulin, complicated cases of diabetes, subjects with visual and auditory disturbances, history of any recent illness, history of peripheral neuropathy, history of muscle weakness, severe anaemia, history of psychological disorders & neurovascular complications are excluded from the study.

PC1000Hz reaction timer was used to measure auditory and visual reaction time.

#### RESULTS

Auditory and visual reaction times of type 2 diabetes mellitus patients were significantly higher as compared to those of non-diabetic control group. The p value for visual reaction time was 0.001 and that for auditory reaction time was 0.003.

#### CONCLUSION

Reaction time measurement can be used for early diagnosis of peripheral neuropathy in patients with type 2 diabetes mellitus before it is clinically manifested. Hence it can be considered as a simple non-invasive method for the early diagnosis of peripheral neuropathy in type 2 diabetes patients.

#### KEYWORDS

Type II Diabetes Mellitus, Diabetic Neuropathy, Auditory and Visual Reaction Time.

**HOW TO CITE THIS ARTICLE:** Pramila T, Sindhu R, Vinay AV, et al. A comparative study of auditory and visual reaction times in type ii diabetic and non-diabetic individuals. J. Evid. Based Med. Healthc. 2018; 5(42), 2929-2931. DOI: 10.18410/jebmh/2018/599

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#### BACKGROUND

Diabetes mellitus is a disease in which the body's ability to produce or respond to the hormone insulin is impaired. As a result, there is abnormal metabolism of carbohydrates resulting in hyperglycaemia. Diabetes is a major cause of morbidity and mortality, though these outcomes are not due to the immediate effects of the disorder. They are instead related to the diseases that develop as a result of

chronic diabetes mellitus. Chronic Diabetes mellitus can affect the micro and macro vascular systems, Kidney, Eyes & Nervous system. Peripheral neuropathy is one of the major complications of diabetes and is the major contributor to morbidity and mortality secondary to diabetes mellitus. The severity of Peripheral neuropathy in diabetes mellitus depends on the duration and degree of glycemic control.<sup>1</sup>

There is constant increase in the number of cases with diabetes mellitus worldwide. As the number of cases of diabetes mellitus increase, there is more likely increase in the complications associated with it<sup>2</sup> which result in increase in the morbidity and mortality associated with diabetes mellitus.

Reaction time is defined as the interval between the presentation of a stimulus to a subject and the subject's response. A reaction time measurement is a reliable indicator of processing of sensory stimulus by central nervous system and it's execution in the form of a motor

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*Financial or Other, Competing Interest: None.*  
*Submission 19-09-2018, Peer Review 23-09-2018,*  
*Acceptance 06-10-2018, Published 09-10-2018.*  
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 DOI: 10.18410/jebmh/2018/599



response.<sup>3</sup> Auditory and visual reaction time is considered as an ideal tool for measuring sensory motor association.<sup>4,5</sup>

Diabetes affects peripheral nerves in the somatosensory and auditory system, slows psychomotor responses, and has cognitive effects, all of which may affect reaction times.<sup>6</sup>

Diabetes mellitus over a long period may affect balance and there are more chances of slip, fractures, non-healing ulcer, finally resulting in amputation of limb and disability. Hence, Screening for Neuropathy earlier before it manifests clinically becomes mandatory.<sup>1</sup>

This study was undertaken to study the auditory and visual reaction times among type 2 diabetes patients for early diagnosis of peripheral neuropathy and to reduce the morbidity and mortality associated with it.

The study was approved by the institutional ethics committee

**Aims and Objectives**

- To measure Auditory and Visual Reaction times in Type II Diabetics
- To measure Auditory and Visual Reaction times in healthy non-diabetic controls
- To compare the Reaction times between both the groups

**MATERIALS AND METHODS**

The study was conducted on fifty subjects. Twenty-five were patients of Type 2 Diabetes Mellitus in the age group of 40-60 yrs. who presented to the Diabetic outpatient clinic of PESIMSR. Twenty-five were age matched controls.

**Inclusion Criteria**

Type 2 diabetics of more than 5 years duration on oral medication.

**Exclusion Criteria**

Alcoholics, Smokers, H/o Hypertension, Subjects on insulin, complicated cases of diabetes, Subjects with visual and auditory disturbances, H/o any recent illness, H/o of peripheral neuropathy, Muscle weakness, severe anaemia, H/o psychological disorders & Neurovascular complications

A written informed consent was taken from all the subjects. Reaction time apparatus (PC 1000 Hz reaction timer) was used to measure auditory and visual reaction times. All the subjects were made familiar with the recording by giving practice sessions.

**Procedure for Recording**

The subject is instructed to click on a button when he sees a red light as quickly as possible for recording of visual reaction time, when he hears a click sound for recording auditory reaction time. Red light is selected for the experiment as it persists for a long time in retina.<sup>7</sup> The reaction time was measured from the recorded data using audacity software. The reaction times were recorded in seconds and the minimum of the three readings was considered.

The mean and standard deviation was computed in MS excel 2007 version. The comparison of mean was done using the unpaired t –test.

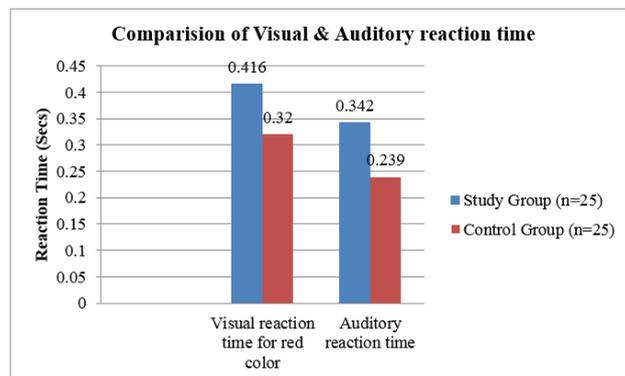
**RESULTS**

Mean age of 25 type 2 diabetic subjects was 48.8 years and 25 non-diabetic subjects were 48 years. Mean values of both visual reaction time (VRT) and auditory reaction time (ART) in type 2 diabetic group were greater than controls and the difference was statistically significant (p<0.05) (Table -1).

Reaction Time (Seconds)	Study Group (n =25) (Mean ± SD)	Control Group (n=25) (Mean ± SD)	P Value
Visual reaction time for red colour	0.416 ± 0.113	0.320 ± 0.085	0.001*
Auditory reaction time	0.342 ± 0.141	0.239 ± 0.089	0.003*

**Table 1. Comparison of Visual and Auditory Reaction Time in Study and Control Group**

\*P value <0.05 statistically significant.



**Graph 1. Comparison of Visual and Auditory Reaction Time in Study and Control Group**

**DISCUSSION**

Diabetes Mellitus affects the peripheral nerves, slows psychomotor responses and has cognitive effects on those individuals who do not have a proper metabolic control. Autonomic dysfunction,<sup>8-10</sup> slowing of reflexes can be seen in patients with Type 2 Diabetes Mellitus over a period of time which can lead to increase in the time to react to a number of external stimuli of different modalities.<sup>11</sup>

In our study, visual reaction time and auditory reaction time was prolonged in patients with type 2 diabetes mellitus when compared to healthy non-diabetic control group, as shown in Table 1. Our study findings were consistent with the earlier studies.<sup>1,7,12,13</sup>

In our study we found that visual reaction time is longer than auditory reaction time. The reason for this is the fact that the visual reaction time involves chemical changes in its occurrence. Also, the visual pathway involves many collateral pathways to various association areas and hence a greater delay in comprehension of visual stimulus.<sup>7</sup>

Studies have shown that delayed reaction time in type 2 diabetes mellitus group is due to delayed motor nerve conduction velocity secondary to axonal degeneration of both myelinated and unmyelinated fibers, axon shrinkage, axonal fragmentation, and thickening of basement membrane and microthrombi.<sup>13</sup>

Peripheral neuropathy is often seen in patients with diabetes mellitus. According to some authors, there is also additional slowing in processing of signals by the central nervous system in type 2 diabetes mellitus. This can also lead to prolongation of whole-body reaction time.<sup>12</sup>

According to previous studies, Reaction time is a measure of function of sensorimotor association<sup>5</sup> and Performance of an individual.<sup>14</sup> It has physiological significance and is a simple and non-invasive test for peripheral as well as central neural structures.<sup>15</sup>

Measurement of visual and auditory reaction times among type 2 diabetes patients can be used for early diagnosis of peripheral neuropathy before it is clinically evident to reduce the morbidity and mortality associated with it.

### CONCLUSION

The visual and auditory reaction time was prolonged in Type 2 diabetes mellitus patients on oral medication than in control. Measurement of reaction time can be used for early diagnosis of peripheral neuropathy in patients with diabetes mellitus without clinical signs or symptoms.

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