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A Comparison of Athletes, Healthy Controls, and people with type 1 Diabetes to see how fast they react to sounds and images

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***Abstract** - Autonomic dysfunction develops over time in people with diabetes mellitus. That typically means that the outlook is not good. The test of reaction time is easy and painless, and it may be used to evaluate both the peripheral and central neurological systems. Diabetic patients' response times may be monitored to detect neurological impairment before it becomes clinically apparent. The impact of type 2 diabetes mellitus on response speed is an area that has seen little research. Because of this, researchers set out to see whether T2DM slowed participants' reactions to both auditory and visual stimuli.*

***Keywords** - Athletes, Healthy controls, People, Type 1 diabetes, Sounds, Images*

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INTRODUCTION

High blood glucose levels, caused by either an insulin deficit or insulin resistance, are a major contributor to mortality and morbidity in people with diabetes mellitus (DM). India, the present diabetes capital of the world, is expected to have 101,2 million diabetic patients by the year 2030, according to the World Diabetic Federation. The micro- and macrovascular systems, the kidneys, the eyes, and the nervous system are all impacted by abnormal glucose metabolism. One of the microvascular consequences of diabetes is neuropathy, the severity of which is correlated with the length and degree of glycemic control, as measured by the Blood level of glycated Heamoglobin (HbA1C) [1-5]. A person's ability to quickly and accurately process visual and auditory stimuli is a key indicator of their overall success. In Type-II DM, increased levels of HbA1C have been linked to the development of neuropathy. Slips, fractures, and nonhealing ulcers, which may lead to amputation and disability, are all possible consequences of the decrease of response time seen in people with chronic Type-II DM. Assessing the correlation between HbA1c and reaction time as a means of screening for neuropathy before to its clinical manifestation is now required [6]. Thus, the purpose of this investigation is to examine the connection between glycosylatedHbA1C and both visual and auditory reaction times in patients with long-term Type II diabetes [7, 8].

The speed with which an organism reacts to a stimulus is quantified by its reaction time (RT). In this context, RT refers to the amount of time it takes for a person to voluntarily produce a suitable reaction after being presented with a stimulus. Three different varieties of RT are discussed. There is just one stimulus and one possible reaction in (1) Simple RT. Certain stimuli should elicit a reaction, while others should not, like in the case of the Recognition RT. With the third kind of RT, "choice," there are many possible reactions to each input. [9-11].

The notion of RT was initially described by Ab Rayhn al-Brn. Franciscus Cornelius Donders (1865) was a Dutch biologist who was among the first to systematically measure human RT using a telegraph-like instrument designed in 1840 by Charles Wheatstone. Before his research, there is little to no documentation of attempts to assess human RTs in the literature [12].

The human RT mechanism relies on the recognition of the input by the neurological system. After then, the message is sent to the brain via the neurons. From there, the signal goes down the spinal cord and out to the extremities. The brain sends signals to the motor neurons, which subsequently instruct the hands and fingers on what to do. Mean simple RTs for adults in their twenties have been generally acknowledged to be about 190 ms for visual stimuli and 160 ms for auditory ones. The real-world effects of RT in reaction to an event may be profound. Quick RTs may be rewarded (for example, in sports), whereas sluggish RTs might have serious implications (for example, when driving and in problems of road safety) [13, 14]. Age, sex, dominant hand, central vs. peripheral vision, practise, weariness, fasting, breathing cycle, personality type, exercise, and IQ are only few of the variables that might impact a person's average RT.

There are hardly any studies in the literature that look at RTs among medical students. So, this research was done to advance knowledge in the RT industry. The goals of the current investigation are to [15] I identify whether RT varies depending on the receptor system being studied, (ii) identify whether there is a difference in RT between the sexes, and (iii) identify whether there is a difference in RT between medical students who lead sedentary lifestyles and those who exercise regularly [15].

A high degree of performance in terms of physiological and motoric features is required of the athlete if he or she is to achieve success in sports. With activities that call for quickness and short distances, the athlete has an advantage if they can go out in front of their opponent. The literature review reveals that the key variables influencing the performance of athletes and inactive persons are their physical structure and anthropometric parameters. The ratio of body fat to lean body mass is a crucial indicator of health and performance for both athletes and couch potatoes [16-18]. The ability to excel in sports depends on a number of factors, including body composition, which is impacted by body fat ratio, and which includes strength, endurance, flexibility, and agility. A person's somatotype may be determined with the use of anthropometric measures and is a categorization based on the parts of their physical structure that takes into account their exterior traits. The somatotype is the scientific assessment of a person's unique combination of delicateness, muscularity, and mass, as well as the characterization of that combination in terms of the individual's morphological form.

Somatotype, therefore, is the end result of size-independent processes involving the development of body composition. The somatotype approach characterises the human body as a whole. When looking at the big picture of sports, it can be unfair to declare one somatotype superior to another. Inclusion of persons who do not have a regular sports life and who live a sedentary life is expected to disclose objective outcomes of somatotype on sport performance, which would be useful in dispelling this misconception. Because different sports have different biomotor characters, they may require different customised parameters, it is thought that the results will be subjectively affected, for example, when 30 metres (m) running scores are obtained from an ectomorphic swimmer and an ectomorphic marathon athlete [19].

Reaction time is one of the key factors that determines success in sports. The time it takes to respond to an unexpected, low-priority signal is called the "reaction time" [20]. Reaction time reflects the initial muscle response of a person to a stimulant or the time that passes before they move, whereas strength is the primary need for movement performance. All three of the senses may be stimulated by different kinds of stimuli. Long-term studies have demonstrated that training may decrease response time, which is a game-changing element in many sports.

RESEARCH METHODOLOGY

This is a controlled experiment with a selection of unique participants. In all, there were 120 participants in the sample, spanning the ages of 20 and 30. 40 basketball players (Group I), 40 healthy volunteers (Group II), and 40 people with Type 1 diabetes (Group III) were studied. A few males and a few girls were snatched up.

All of the people who participated in the research had normal vision and were able to see well without the need of corrective lenses. Individuals in this study did not have a diagnosable mental disease that adversely affected their psychomotor skills, nor did they have any pathology or damage to their upper limbs. Each of these circumstances raises the possibility that it is influencing participants' response times and so serving as a confounding variable. Patients with diabetes should have well-controlled blood glucose levels and a mean duration of diabetes of less than ten years. Patients with diabetes who showed signs of peripheral neuropathy, muscular weakness, or neurovascular problems were also disqualified from participation in the study. Study participants were given detailed information about the experiment and given the opportunity to sign a permission form before any data were collected.

This research was carried out using the "Audio-visual reaction time apparatus RTM 608" by Medicaid systems. The instrument has a 0.001-second resolution and a plus-one-digit precision. Sound stimulus (constant sound on speaker) and image stimulus may both be delivered (shooting red, yellow and green lights). Sound stimuli at low and high frequencies, as well as red, green, and yellow light stimuli, were used to capture responses. The dominant hand's index finger is used to alter modes of response as soon as stimuli are detected. The countdown clock showed how long it took for a response. A total of 10 attempts were given, and after some practise three readings were taken for each metric. The value for the response time task was determined by averaging the subject's three separate readings, and this information was recorded with the subject's other relevant data. An unpaired t test was used to examine the data. When it came to crunching numbers, we turned to SPSS (Version 14.0.0). The P 0.05 threshold was used for all statistical analyses.

RESULT AND DISCUSSION

The mean and standard deviation are used to summarise the dat [Tables 1 and 2 and Figures 1 and 2].

There were statistically significant differences between the two groups, the diabetes and the controls. Reaction times to low and high frequency sound stimuli and to red, green, and yellow light stimuli were significantly faster in the control group compared to the diabetes group (P 0.001 for both sexes).

Athletes and controls showed significantly different response times to low-frequency (P < 0.05 in men and females) and high-frequency (P <0.05 in males) noises, as well as to red-, green-, and yellow-colored light stimuli (P <0.05 in males).

Male and female performance in each group showed no statistically significant differences in response times.

Table 1: Sounds reaction time Comparison

Audio reaction time		Diabetes	Athletes	Controls
		mean ± SD	mean ± SD	mean ± SD
High	Male	0.2531 ± 0.175**	0.1614 ± 0.175*	0.1795 ± 0.128
Frequency	Female	0.2561 ± 0.505**	0.1699 ± 0.180	0.1802 ± 0.167
Low	Male	0.2599 ± 0.468**	0.1643 ± 0.162*	0.1852 ± 0.219
Frequency	Female	0.2595 ± 5.77**	0.1704 ± 0.180*	0.1821 ± 0.168

*P < 0.05, **P < 0.001

Table 2: Images reaction time Comparison in three groups

Audio reaction time		Diabetes mellitus	Athletes	Controls
		mean ± SD	mean ± SD	mean ± SD
Red	Male	0.2667 ± 0.489**	0.1614 ± 0.183*	0.1889 ± 0.205
Stimuli	Female	0.2684 ± 0.526**	0.1751 ± 0.192*	0.1897 ± 0.201
Green	Male	0.2721 ± 0.490**	0.1709 ± 0.179*	0.1931 ± 0.216
Stimuli	Female	0.2734 ± 0.524**	0.1772 ± 0.180*	0.1953 ± 0.217
Yellow	Male	0.2734 ± 0.494**	0.1690 ± 0.179*	0.1941 ± 0.212
Stimuli	Female	0.2792 ± 0.570**	0.1808 ± 0.204	0.1932 ± 0.209

*Signifies P < 0.05, **Signifies P < 0.001

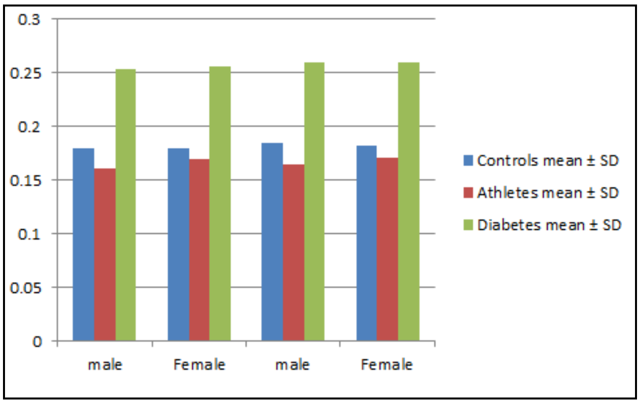

Figure 1: Sounds reaction time Comparison

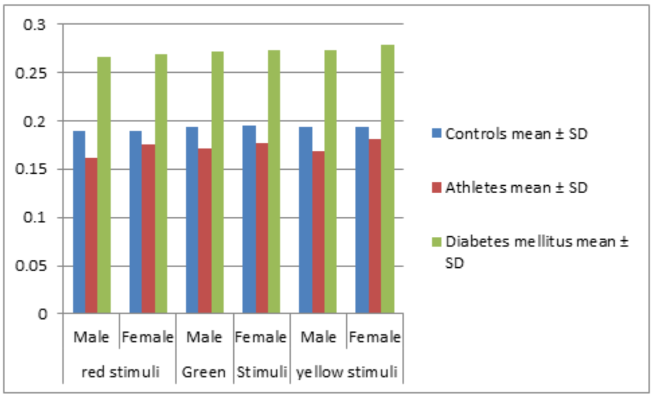

Figure 2: Images reaction time Comparison

Research discovered that those with diabetes mellitus had slower response times to either visual and auditory stimuli than people without the disease or who were elite athletes. This observation may be explained by the fact that people with diabetes have higher than normal blood glucose levels, which leads to chemical alterations in the neurons and destroys the blood vessels that provide those nutrients and oxygen. Low amounts of nitric oxide may induce narrowing of the blood arteries that feed the nerves in diabetic patients, while high levels of glucose metabolism reduce the nitric oxide in neurons, which widens the blood vessels. In the neurons, elevated blood glucose levels cause a buildup of sorbitol and a depletion of myoinositol by disrupting a number of metabolic processes. The nerve's signal-transmitting capacity is diminished as a result of these alterations.

Myelinated and unmyelinated axonal degeneration, axonal shrinkage, axonal fragmentation, basement membrane thickening, and microthrombi all contribute to slower conduction velocity in motor nerves [21, 22], which in turn causes slower reaction times.

The therapeutic significance of such subtle shifts is unclear. Perhaps adversely affected are those engaged in high-intensity sports such as boxing and basketball, where split-second decisions are often required?

Athletes can complete the speed and accuracy assignment with more proficiency than controls because of their heightened attention, awareness, attentiveness, and muscular coordination. This action causes an arousal in highly trained athletes, which aids in their ability to maintain awareness of environmental stimuli. Evidence suggests that the stimulation of the central nervous system brought on by physical exercise may boost cognitive function. Increases in alertness after exercise may stem from changes in neurophysiology, such as the concentration of plasma catecholamines [23].

Adaptive increases in mitochondrial content and respiratory capacity in the skeletal muscles used during exercise training lead to glycogen sparing and an increased capacity to oxidise fatty acid, which in turn leads to an increase in work time, a delay in fatigue, an increase in enzymatic activity, an increase in the oxidation of ketones, and their removal [24]. Thus, these benefits may be responsible for the improved performance of players' reaction times.

CONCLUSION

Autonomic dysfunction develops over time in people with diabetes mellitus. That typically means that the outlook is not good. The test of reaction time is easy and painless, and it may be used to evaluate both the peripheral and central neurological systems. Diabetic patients' response times may be monitored to detect neurological impairment before it becomes clinically apparent. There were no discernible differences between the sexes in this investigation. Although while men generally outperformed women on response time tests, this difference was not statistically significant, the players' superior performance on response time tests implies that this metric is useful for gauging athletic prowess and cautions diabetics who engage in fast-paced sports to be wary of the greater risk of injury that comes with training for such competitions.

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