REACTION TIME AND GLYCAEMIC LEVELS IN NON-INSULIN DEPENDENT DIABETES MELLITUS

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Disturbances in peripheral and autonomic nervous system have been extensively studied in diabetic subjects. Alterations in the central nervous system functions with varying degrees of hyperglycaemia have been relatively less extensively studied[1]. Cognitive functions have been found to be affected with hyperglycaemia by many workers. The aim of the present study was to correlate the changes in reaction time as an index of cognitive function, with reduction in glycaemic levels in subjects with NIDDM.

Materials and Methods:

The study included twelve subjects of NIDDM (equal number of males and females). The age of the subjects ranged between 30 and 60 years. Among the 12 subjects, 4 were obese (BMI>27 for males and >25 for females) and the rest were non-obese. After estimating the fasting blood sugar all the patients were given l0mg. of glybenclamide and continued in the fasting state. Blood sugar was estimated at 2 hours and 4 hours after the drug administration. The reaction time was performed in the fasting, 2 hours and 4 hours after the drug administration, using the Reaction time apparatus (Modle PMC 8501). The Reaction Time Apparatus measures reaction time, colour identification, eye hand co-ordination, perception abilities and psychomotor performances in general. The stimulus is given by the buzzer together with one of the three coloured lights (red, amber or green). The subject is required to respond to the stimulus by pressing the appropriate coloured button. The programme selected for this test was the Simple Reaction Time.

In the Simple reaction time, a red Led is put on and remains so till any key is pressed: the trial number and the reaction time are displayed. The new stimulus (red, amber or green) is given after a random interval so that the subject does not get conditioned to specific time interval and is thus unable to guess the start of the stimulus. The stimulus will not be given if the subject is holding one or more keys pressed. The time is measured from the start of the stimulus to the time any key is pressed in increments of 0.001 second with quartz controlled accuracy. At the completion of the set number (in the case 10)of trials a two note dual tone signal is given and the average time displayed.

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Results:

The blood sugar at 0, 2 hours and 4 hours with the percentage changes are given in Table-I. As would be seem from the tables there was an appreciable drop in blood sugar at 2 and 4 hours. The mean blood sugar decrement at 2 hours was 26.79% and at 4 hours 46.7%.

Table 1
Patients' Blood Sugar Level

Patient No.	Blood sugar mg% 0hr.	Blood sugar 2 hours after drug (mg%)	Percentage decrease 0 vs 2 hr.	Blood sugar 4 hours after drug (mg%)	Percentage decrease 0 hr. vs. 4hrs.
1.	148	76	48.65%	84	43.25%
2.	156	128	17.95%	104	33.33%
3.	176	112	36.36%	100	43.18%
4.	188	136	27.66%	84	55.32%
5.	228	156	81.58%	128	43.86%
6.	232	224	3.45%	148	36.21%
7.	240	172	28.33%	128	46.67%
8.	240	196	18.33%	148	38.33%
9.	296	200	32.43%	132	55.41%
10.	320	244	23.75%	152	52.50%
11.	328	216	34.15%	164	50.00%
12.	360	272	24.46%	180	50.00%
Mean (n = 12)	242.67	177.67	26.79%	129.33	46.71%

The reaction time at 0, 2 hours and 4 hours are given in Table-II. The reaction time was shortened as the sugar levels fall and reach euglycemic levels. The mean decrease in reaction time at 2 hours and 4 hours was 0.06 and 0.08 sec. respectively.

Table-II
The Reaction Time

Patient No.	Reaction time (sec) 0 hour	2hrs.	4 hrs.
1.	1.07	0.88	0.94
.2.	0.93	0.87	0.85
3.	0.82	0.77	0.75
4.	0.71	0.76	0.71
5.	0.84	0.82	0.79
6.	0.89	0.88	0.84
7.	1.11	1.11	1.00
8.	0.94	0.90	0.88
9.	0.91	0.79	0.73
10.	0.91	0.88	0.87
11.	0.75	0.68	0.71
12.	0.91	0.68	0.71
Mean (n=12)	0.90	0.84	0.82

The comparison of the mean blood sugar decrement with mean reduction in reaction time is given in Table-Ill.

Table-Ill
Glycemic Change Vs Reaction Time

	Mean Blood sugar decrement (mg%)	Mean reduction reaction time (mg%)	
At 2 hours	76.66 ±38.27	0.085±0.071	P<0.01
at 4 hours	115.16±42.56	0.094 ±0.054	P<0.01

The correlation between the mean blood sugar decrement and mean reduction in reaction time was statistically significant (p 0.01) at 2 hours and 4 hours after the Glibenclamide challenge.

Discussion:

Selective impairment of cognitive skills have been documented in subjects with IDDM[2]. The rapid motor response following a visual stimulus being delayed in diabetic subjects has been observed at extremes of glucose levels compared to euglycemic state[3]. Besides the delayed visual motor co-ordination, verbal memory, learning and visual memory were also found to be impaired.

Attention and fine motor skills assessed by the visual reaction time was found to be slowed at altered glucose levels by Clarrisa Smith Holmes et al. (1983). A sex related difference in the performance could not be established. In the present study a satisfactory reduction of blood sugar was achieved with oral glybenclamide. The reaction time improved with a drop in blood sugar. As has been pointed out the correlation between mean blood sugar decrement and the mean reduction in the reaction time attained statistical 'significance. The reaction time was minimum when the glycemic levels approached euglycemic state.

In our study none of the patients experienced hypoglycemia. Hence an alteration of the reaction time at low blood sugar levels, observed by many authors could not be established by us. The varying inter stimulus intervals and the varying colour in the screen eliminated any possible manipulation of the test result by the subjects.

The basis of slowing of reaction time and the blunting of certain other mental faculities has not been precisely defined. Acute changes in metabolism with altered blood sugar levels are not likely to influence the conduction of nerve impulses. Paradoxically Flender and Lifshitz* observed improved fine motor coordination at elevated blood glucose levels. The clinical significance of such subtle alterations of cognitiva skills are speculative[6]. Probably such alterations might prove deleterious in subjects required to take instantaneous decisions.

Conclusion:

In the present study in a small number of NIDDM subjects a reduction in the glycemic levels from the hyperglycemic range resulted in a significance improvement in the visual reaction time, one of the indices of cognitive skills routinely performed in diabetic subjects.

References:

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