Nat. Volatiles & Essent. Oils, 2021; 8(2): 42-53

NVEO
Natural Volatiles &
Essential Oils

Association Of Type2 Diabetic Mellitus And Cognitive Function In Baseline Of Middle Aged Peoples

MS.PYARYJOY[1] , DR. M.REJADHEESH[2] , DR.R.VIJAYAKUMAR[3]

[1]RESEARCH SCHOLA, LNCT UNIVERSITY, BHOPAL, INDIA.

[2]RESEARCH SUPERVISOR, DEPARTMENT OF MEDICAL MICROBIOLOGY, LNCT UNIVERSITY, BHOPAL, INDIA.

[3]PROFESSOR PHYSIOLOGY, SLIMS, PONDICHEERY, INDIA.

ABSTRACT

The increasing rate of Type 2 diabetes (T2DM) all over the world has the serious implication for health and economic and it is a complicated condition also. One of the problems is influence of diabetes on cognitive function. In middle age adults having T2DM has been established the correlation among the diabetes and impairment of cognitive in subjects. In this study we examined the characterization of diabetic 2 patients and their risk factors with cognitive function. The participants compared with the diabetic related factors such as age, sex, lipid profiles and duration of diabetes observed the variables in their levels. The scores on cognitive tests showed the decline in attention, processing speed but strength in executive function. The health markers related to diabetes were associated to many domains of cognition. Because of the small sample size, lipid profiles were treated prudently.

Key words: Diabetes, cognition, pathogenesis, Hba1c and lipid profiles.

INTRODCUTION

Diabetes Mellitus

Diabetic mellitus is a class of metabolic disease having long term hyperglycaemia and changes in the metabolism of fat, carbohydrate and protein due to the absolute or relative deficiency of secretion of insulin or its action. Chronic hyperglycaemia is associated with particular microvascular and high risk of complications of macrovascular (Baker et al., 2011).

Cognitive functions

The cognitive functions explained “acquisition, processing, integration, storage plus recovery of information”. It consists of attention, perceptions, and memory and executive functions in increased order planning and decision making (Sullivan & Feinn, 2012).

Various cross-sectional and increased populations studies are depends on the relationship of cognition impairment in type 2 DM and different defects in cognition includes lower in psychomotor activity speed, verbal memory, processing speed, working memory, executive task, function of complex motor, fast recall" have been reported (Guo et al., 1999). The interrelation of diabetes with cognitive impairment leads to period of diabetes, control of diabetes, onset of age and various difficulties of DM and lesser duration of glucose control above decline of cognition and development of cognitive function.

The one of the complication in DM is involvement of central nervous system in 28 younger's having DM at the age of <55 with period of 5-18 years and 28 non-diabetic control participants were observed similarly. By using MMSE, examination of cognitive status of neurobehavioral and latencies P300 was observed. On cognitive function, there is no link among duration of diabetic and levels of HbA1c. In conclusion, involvement of cognition impairment must be incorporated into complication of type2 DM (Kerolaet al., 2011).

Interrelation of the markers and impairment of cognition are recognized regularly. Between these, the type 2 DM has a good impact on society and considered as a world pandemic and serious health issue of public. So the interrogation of impairment of cognition in type 2 diabetes is more important to face daily challenges of the disease and to accept the medication, therapy and nutrition life. In this study we examined the characterization of diabetic 2 patients and their risk factors with cognitive function.

MATERIALS AND METHODS

Design

This study recruits and designed with cross-sectional correlation along with dependent variables that has the T2DM with impairment of cognitive and independent variable that the participants compared with the diabetic related factors such as age, sex, lipid profiles and duration of diabetes. The cognitive function has four major provinces includes hurry, impression, observation and executive functions.

Eligibility Criteria

The eligibility criteria for this study includes participants had the diagnosis ofT2DM with other physical health problems, psychological issues, comorbidities and cognitive impairment. This research study was instructed with inclusion and exclusion criteria confirmed from the outsets of participant's recruitment and patient's knowledge.

T2DM diagnosis

For this study the participants were need to have a confirmation of T2DM and attainable with both the types of diabetes either T1DM or T2DM.

Mental Status Examination Questionnaire: To analyze the cognition level to the participants.

Medical comorbidities:

The participants have the diabetes in the difficulty stage then they emerge with before or after progressing condition can affect the cognitive function (Kilander, Nyman, Boberg, Hansson, &Lithell, 1998; Hassinget al., 2004). For example, the high blood pressure and cardiovascular disease and high level of fat in blood so their lipid profile was measured (Gorelick et al., 2011).

Measurement of Anthropometric Indices

Sex of Participants

From the six participants, three were selected as women and three were men. There was no sex bias performed and identified by the chi square test.

Birth Country and Language

The participants were selected in this study that are all born in Tamilnadu, India and had English as a second additional language. There were no significant differences in the scores on the tests of cognition among the participants who spoke English.

Employment status

From the six participants, the four were looking for employee and two were un employee with some capacity.

Weight of subject

The participants were asked to wear light clothes to standing with their relaxed arms at their sides with two feet closing each other. Using the standard portable weighing machine, the participant's weight was measured in kg.

Height of subject

Using the stadiometer, informed to stand in erect position, the height of the participants was measured in cm.

BMI

The participants BMI were estimated using the Quetelet's Index in the range of BMI = Weight (Kg) / Height (m2).

Measurement of Blood Pressure

The participants were instructed to sit and relax for 5 minutes in a waiting room at room temperature. Then the blood pressure was measured in six participants by using sphygmomanometer having a cuff size of 25 x 12.5cms.

Blood Investigation

For collection of venous blood the median cubital vein was selected. Then it was cleaned using spirit and cotton swab, a sterile needle was fitted with 5ml syringe was placed into the vein and 4ml of blood was taken and placed into the containers separately with various anticoagulants.

Hba1c

The measurement of HbA1c by Turbidimetric immunoassay method. Participants having T2DM are asked to maintain the Hba1c level with healthcare professionals. It was received from the participant's medical record after getting permission from theirs. The participants are advised to keep their blood glucose level below 48mmol/mol. In our study, majority of the participants does not have their ideal control of diabetes type II.

Lipid profile

From the all participants, the four lipid profiles includes total cholesterol, HDL, LDL and TG were measured. The optimal control for these lipid profiles should be total plasma cholesterol <4.5-mmol/L (~175 mg/dL) and LDL <2.5mmol/L (~100mg/dL), concentration for HDL and TG, HDL concentrations in male <1.2mmol/L (~40mg/dL) and female <1.2mmol/L (~40mg/dL) and TG >1.7mmol/L (~150mg/dL).

RESULTS AND DISCUSSION

The descriptive statistics were used for the sample to find out the mean, standard deviation (SD), distribution of data in the demographic, type II diabetes (T2DM) and scores for age-scaled of the cognitive tests. Moreover, data was explored for skewness, kurtosis and the Shapiro-Wilk statistics for the normality for the parametric conditions (Table-1).

Table-1: Descriptive Statistics for Participant Characteristics

Markers	Mean	SD	Skewness	Kurtosis	Shapiro-Wik Sig
Age	44.90	9.20	-.747	-1.094	.089
Education	13.8	2.57	-.080	-1.326	.896
Duration	72.90	66.90	.596	-1.332	.065
Hba1c	76.15	21.30	-.151	-.723	725
Total Cholesterol	4.05	1.01	-.005	.418	.599
HDL	1.08	.33	.824	-.004	.171
LDL	2.00	.88	.342	.368	.910
Triglycerides	2.15	1.21	1.161	1.341	.189
Beck Depression	16.10	12.22	.109	-1.296	.495

Beck Anxiety	15.00	15.00	.423	-1.453	.184

The shape and it showed lower than 1 indicates the skewness; the peak showed more than 3 indicates the kurtosis and the data does not have a curve at normal p< indicates the Shapiro-Wilk significant (Field, 2013). Therefore, the test scores for participants do not distributed normally and lower number of participants. It represents the unsatisfactory data for linear statistics and used non-parametric tests.

Diabetes is considered as a widespread disease with hundred millions of diabetics along the world. It is a persistent disease and also a lengthy complicate disorder. The cognitive dysfunction also called as long term complicate disorder but its advantage is still abandoned in diabetes (De la Monte & Tong, 2014). The cognitive status is essential for the perception of the disease and its adherence. In this research work, totally six diabetic participants were selected as study group and age, sex, BMI and education status were determined from them. These observations of this study showed the presence of dysfunction of cognition in type2 diabetes participants. These findings were related with some previous works that described the functions of cognitive in type 2 diabetics.

For the measurement of neuropsychological tests showed the changes in the age and used scaled scores that the age was modified. By using the Komogrov-Smirnov (K-S) test, the Descriptive statistics were sustained and compared to the putative norms. This test proved the enough sampled scores differ from normal distributed scores by the mean and SD (Field, 2013). The significant results denotes the significant sample distribution vary from normal distribution. This showed the comparison of cognitive tests performance of participants from normal data (M=6, SD=3), that concerned to subsets from the TOPF (Test of Premorbid Functioning), WAIS (Wechsler Adult Intelligence Scale), WMS (Wechsler Memory Scale) and DKEFS (Delis Kaplan Executive Function System).

From the results of table-2 and 3 represents the visual inspection of data from study sample, no clear outliers or difficulty areas and most of the data were issued the mean. The least scores were recorded in the Number-Letter Switching and higher in switching output and validity.From the studies sample, the relative strong in Switching Output and Accuracy (Executive Function) and relative week in Digit Span and Digit Symbol Coding i.e. speed of processing and attention of the population sample (Table-4 and 5). The relative weakness is take part in the area's subsist research that which recommended the speed of processing and attention (Manschotet al., 2006). But, relative strong would anticipate with the T2DM participants sample (Vincent & Hall, 2015).

Table-2: Descriptive and Distribution Statistics for Participants' Test Scores for Verbal Attention and Processing Speed

Subtests (SS)	Mean	SD	Skewness	Kurtosis	Shapiro-Wilk
Optimal Ability	9.40	2.503	-1.048	1.335	.127
Verbal Attention					
Digits Forward	9.40	5.125	.726	-.797	.129
Digits Backward	8.80	3.155	**1.529**	2.155	.036
Digits Sequencing	9.00	2.055	-1.057	.386	.040
Digits Span	8.50	3.837	1.040	.411	.168
Processing Speed					
Colour Naming	8.20	2.573	.213	-.513	.574
Colour Word	9.20	3.048	-.708	1.092	.600
Visual Scanning	9.60	2.171	.319	-1.343	.321
Number Sequencing	8.00	4.295	-.042	-1.862	.128
Letter Sequencing	9.20	3.795	-.727	-.218	.573
Digit Symbol Coding	8.50	2.415	917	-.147	.091

Table-3: Descriptive and Distribution Statistics for Participants' Test Scores for Executive Function, Learning & Memory and Verbal & Visuo-Spatial

Subtests (SS)	Mean	SD	Skewness	Kurtosis	Shapiro-Wilk
Executive Function					

Letter Fluency	9.90	5.065	.535	-.588	.663
Category Fluency	11.80	4.756	-.077	-1.929	.143
Switch Output	12.30	4.877	-.622	-355	.308
Switch Accuracy	12.70	3.945	-.793	-.088	.251
Inhibition Scaled	9.80	3.084	-.505	-.681	.481
Inhibition Switching	8.50	4.197	-.879	-.163	.159
Number Letter	7.20	4.104	-.432	-.1598	.187
Learning & Memory - Verbal/Visual					
Story Immediate	10.40	1.897	.498	-..104	-573
Story Delayed	9.70	2.003	-.523	.614	.351
Visual Immediate	9.30	3.653	-.522	-.927	.577
Visual Delayed	10.40	2.951	.320	.198	.912
Verbal & Visuo-Spatial					
Similarities	8.70	3.020	-1.486	1.475	.044
Block Design	8.50	2.369	.251	-1.839	.086

Table-4: Participant data for Neuropsychological Tests compared to Normative Data for Verbal Attention and Processing Speed

Subtests (SS)	Mean of SS of Test	SD of SS of Test	Kolmogrov-Smirnoff Z	p

Optimal Ability	100	15	.798	.547
Verbal Attention				
Digits Forward	10	3	1.099	.179
Digits Backward	10	3	1.099	0179
Digits Sequencing	10	3	1.168	.130
Digits Span	10	3	1.362	.049
Processing Speed				
Colour Naming	10	3	1.099	.179
Colour Word	10	3	.852	.463
Visual Scanning	10	3	.632	.819
Number Sequencing	10	3	1.293	.071
Letter Sequencing	10	3	.660	.776
Digit Symbol Coding	10	3	1.362	.049

Table-5: Participant data for Neuropsychological Tests compared to Normative Data for Executive Function, Learning & Memory and Verbal & Visuo-Spatial

Subtests (SS)	**Mean of SS of Test**	**SD of SS of Test**	**Kolmogrov-Smirnoff Z**	**p**

Executive Function				
Letter Fluency	10	3	.798	.548
Category Fluency	10	3	1.293	.071
Switch Output	10	3	1.415	.036
Switch Accuracy	10	3	1.712	.006
Inhibition Scaled	10	3	.481	.975
Inhibition Switching	10	3	.632	.819
Number Letter	10	3	1.14	.167
Learning & Memory - Verbal/Visual				
Story Immediate	10	3	.798	.547
Story Delayed	10	3	.852	.462
Visual Immediate	10	3	.660	.776
Visual Delayed	10	3	.632	.819
Verbal & Visuo-Spatial				
Similarities	10	3	1.168	.130
Block Design	10	3	1.079	.194

The premorbid functioning tests were used to evaluate the optimal ability of participants to the arrival of illness. This method showed the lack of applied in the research. The area of cognitive functioning was estimated by the comparison of participant's TOPF performance and scores of cognitive tests.The correlation among the Hba1 cand learning and memory tests and construction of verbal-spatial and cholesterol with cognitive tests. Other than the diabetes related health markers were linked with cognitive tests that considered the range of good health (Ebmeieret al., 2006).

The data of visual inspection showed the participant's mean scaled scores and do not have a change or impairment for the test (Mean= >3). There was a development in the comparison of scaled score switch accuracy from the scaled score TOPF (Mean= -3.30) and it showed the enhancement in the optimal ability. And this is the test carried out to show the variability of significant change in the TOPF.

The non-parametric tests were used because of their smaller size of sample and correlated along with the diabetes-related health indicators, diabetic period, Hba1c and lipid profile such as total cholesterol, HDL, LDL and TG. There was no correlation with the TG and HDL (r=-.795, p<.01).The correlation along with cognitive function i.e. scaled scores tests and clinical diabetic information includes Hba1c, lipid profile, and period of diabetes. The correlation of Spearman's-Rho was choosing to estimate the relevant statistics and their associations were observed. The subtest from the learning and memory domain in a visual task, the Hba1c was correlated and showed the visual immediate was measured at r=-.638, p<.01 and verbal-spatial, similarities were marked as r=- .523, p<.05).

In this study, only one participant had their optimum range of Hba1c and most of the participants had recommended levels of lipid profiles.Hba1c was not correlated with learning and memory tests. It denotes the function of cognition affected by the glycated haemoglobin levels. This study was similar with the previous study that research in area, the increased range of Hba1c were related with the decreased cognitive function, loss of memory and all declines (Marden et al., 2017; Kumar & Singh, 2010).

The total cholesterol was related with the different variables includes verbal attention, particularly Digit Span Forward was r=.646, p<.01, Digit Span Sequencing was r=.458, p<.05 and Digit Span was measured r =.503, p<.05 subtests; executive function such as Switch Output was r=.530, p<.05, Switch Accuracy was r=.574, p<.05, Inhibition recorded at r=.550, p<.05, Inhibition Switching was at r=.550, p<.05 and Number Letter Switching was (r=.524, p<.05) subtests; verbal learning and memory, Visual Immediate was at r=.554, p<.05 subtests and visuo-spatial construction measured at r=.623, p<.01).The word Reading subtest processing speed was corresponded with HDL and it was measured at r=-.745, p<.01. LDL was agreed with EF, particularly the subtest of Inhibition was recorded r=.646, p<.05.The triglycerides was tie up with the processing speed of Number Sequencing subtest was r =-.583, p<.05.

In the similar studies denotes that the cholesterol can determine the learning and memory tests but nature of task was difficult to understand. In another study, the increased cholesterol can developed the cognition in some tasks. The high cholesterol level was correlated with the poor cognitive function performance (Solomon et al., 2009). The relationship among various features correlated to diabetes and regards to the biological indicators in the sample are emerged. The Hba1c had lesser correlation with learning and memory and verbal-spatial tasks and the total cholesterol was positively linked with all domains of tests except processing speed and also the total cholesterol highly correlated with the some subtests of higher score such as HDL and TG. The both HDL and TG were negatively agreed with tests of processing speed but the LDL was linked significantly to inhibition.

These observations were feasible with the previous reviews into the area, most of the reviews recommended that younger adults also have the signs of cognitive impairment in the earlier diagnosis of

diabetes (Ruiset al., 2009). Some of the researches denote the peoples having T2DM can deficiency of cognitive domains than non-diabetic controls. The various researchers Awadet al., 2004 reported that the variable domains affect the processing speed, attention and executive function may be influenced. Although, the complication of diabetes established the development of diabetes is the challenging for the research peoples. The levels of conclusion, understanding and contrasting are varied at each level (Lam & Le Roith, 2012).

CONCLUSION

This study concludes that the premorbid functioning of middle age adults with T2DM were perform the cognitive tests for various patterns of cognitive function or diabetic related health markers. The future research will be required in larger scale to evaluate the cognitive impairment in middle age adults with diabetes. Many more research with different techniques or methodologies need to positively determine the correlation among the cognitive function with diabetes.

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