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Analysis Of Changes In Cognitive Test Scores Of Diabetic Type2 Participants

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ABSTRACT

In diabetic mellitus, the lesser known and lesser addressed complications are dysfunction of cognitive. The Diabetes is associated with reduced progressive organ impairment in brain. The diabetic patients have 1.5 times chances to get decline of cognition. The survey of cognitive function of adults with T2DM is dominant to recognize the pathogenesis and effect of situation cross over the lifespan. Six participants with T2DM were enlist with diabetes and finished their cognitive tests of processing speed, attention, executive function, learning and memory. The estimation of optimal ability was also determined. 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.

Key words: Diabetes, cognition, pathogenesis, scores.

INTRODCUTION

Diabetic mellitus

The main demanding health issue of the 21st century is diabetes mellitus. It is a metabolic disorder and group of heterogeneous with long term hyperglycemia and intolerance of glucose. It is called as “well defined type of aging acceleration” and it rush to patient responsibility to progressive disease (Huner, 2015).

The most usual diabetes in Type2 DM and the key factor is resistance of insulin with deficiency of relative insulin and reason for 85 to 95% of diabetes. The reason for the increasing of this disease in most of the countries is sudden changes in social and cultural, urbanization enhancement, modification in dietary patterns, population aging, lack of physical activity and unhealthy behaviors (NCD Risk Factor Collaboration, 2016).

Cognition

The word cognition arise from the word Latin that ‘’cognoscere” meaning is “to suit familiarize with or get to know” and includes mental process and ability that cover transformation, reduction, elaboration, storage, recovery and stored information. This process worried with perceiving, remembering, problem solving and thinking. The process of cognition used the present knowledge and form new knowledge (Chiaravalloti & DeLuca, 2008).

Effect of comorbidities of Type2 Diabetes on Cognitive function

Obesity and cognition: The obesity is considered as a global epidemic problem formed great effects to health. It correlated with heart disorders, hypertension, diabetes and stroke. The new research observed that the obesity has relationship with cognitive function (Alberti, 2010). The systemic inflammation of obesity formed the brain inflammation in hypothalamus and reason for poor results of cognitive.

Hypertension and cognition: The well-knowing reason for the disorder of cerebrovascular is hypertension that observed by dysfunction of cognitive. visuospatial skills, learning, attention, executive functions, memory, psychomotor abilities and perceptual skill tests are correlated to the poor presentation of hypertension (Kannel, 1985).

Dyslipidemia and cognition: The major risk for cardiovascular disease is lipid disorders that are linked with dysfunction of cognitive (Beck & Steer, 1993). The Dyslipidemia caused by increased atherosclerosis and deposition of amyloid and stabilize the decline of cognitive.

Cognitive impairment

It is diminishing the functions of cognition. It takes place in starting to later stage of dementia. These stages have no cognitive impairment, mild cognitive and dementia**.**

Cognitive dysfunction and type2 dm

Diabetic mellitus produce slow but developing organ impairment of brain. Type2 DM is joined to decrease the domain activity of cognitive function like psychomotor speed, activity of frontal lobe, verbal memory, fast recall, slow recall, fluency, preservation and attention of visual (Howe, 1988). And also it takes part in brain abnormalities include structural, functional and metabolic.

Structural changes in brain

The Type2 Diabetes leads macroscopic modification and also microscopic changes in brain. Lots of neuro imaging studies showed the atrophy of cortical and sub cortical and white matter intensities (Shoelso net al., 2007).

Global Brain Atrophy and enlargement of ventricles

Reduction of brain volume and cortical/subcortical caused by the type2 DM and it is observed by the study of neuroimaging. Expanding of ventricles is considered as major indicator for atrophy of cerebral and in type2 DM (Degen et al., 2016). It is noted as retinopathy, HbA1c level and diabetes duration correlated to toxicity of glucose, damage of vascular and hyperinsulinemia.

Regional Atrophy of brain

The major regional atrophy of type2 DM is temporal lobe atrophy present in hippocampus and amygdala atrophy. Type2 diabetes in obese adolescent's patients has the decreased level of brain in frontal lobe. The both white and grey matter reduced.

MATERIALS AND METHODS

Participants and Procedures

This study was an investigated, transverse and anticipated research work. The adults were the participants had type II diabetic mellitus enlisted from the various outpatient and centers of community concentrate on therapy of participants with T2DM.

Participant Characteristics

Totally, the six participants were selected for this study with diagnosis of diabetes T2DM and completed their testing. The participants have their aged with 35 to 60 with the mean age of 44.0. For this study, the participants consisted of following

1. The adults aged 35-60
2. Educatd, able to read and write
3. Skill to understand the English to complete the tests and questionnaires
4. for at least one year diagnosis of T2DM
5. Approach to medications

Measures

At the time of evaluation, the researcher measured all measures in the administration order and suitability of use with the participants in the study.

Recruitment

The participants were engaged with the integrated diabetes care, Chennai. The supply a Diabetes management team had multi disciplinary such as nurse, consultants for diabetes and endocrinology, chiropodist, epistemologist and psychologists.

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. At the recruitment stage, if the participants had any ambiguity they were not selected for the research work.

Demographic information:
The adult age of participants had 35-60 with both sexes.

Medical comorbidities:
The participants have the diabetes in the difficulty stage then they emerge before or after progressing condition can affect the cognitive function (Kilander, Nyman, Boberg, Hansson, & Lithell, 1998).

Informed Consent
The participants have a chance to ask questions and motivate to do and they were given an information papers for reading to sign in it. After the participants signed in the papers then only the test begins and given rights to return it at any time.

Procedure
The procedure for interview took place in meeting room or in clinical room in a hospital. The time taken for completing a session took 25 minutes. The participants demographic information was included date of birth and identity and medical details includes kidney problem and head injury.

Materials
The tests were selected for this study was concord with speed of processing(Stewart & Liolitsa, 1999; Awadet al., 2004) and verbal and visual attention (Manschotet al., 2006). The tests chosen were selected and evaluated by the participants diagnosed with diabetes and cognitive impairment.

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

Optimal Ability
To evaluate the optimal ability or occurrence of disease in neuropsychology by measuring the forms of impairment of cognitive (Hebben & Milberg, 2009). The reading test was conducted by the participants irregularly spells words were asked to pronouncing.

Learning and Memory
For visual and verbal learning and memory, the Wechsler Memory Scale III used (Wechsler, 2009).

Analysis
The raw scores measured were converted into scaled scores and these scores were entered into Statistical Package for Social Sciences (SPSS). The analysis was conducted in data parameters.

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. The examined domains includes ability for optimal, attention of verbal, speed of processing, executive function, immediate and recall memory for verbal and visual and verbal and visuo-spatial.

Schreurs (2010) evaluated the type2 diabetes cognitive status throughout the scores with absence of diabetes subjects. They observed that type 2 diabetes was similar to cognitive dysfunction. The other study done by Resnick et al (2000) reported that the relationship of type2 DM and cognitive dysfunction and observed the cognition impairment was eight times higher in diabetic patients than the control subjects.

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-3). 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).

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).Hu (2011) examined the dysfunction of cognitive and it was considered as a lengthy complicate type2 diabetes. Kodl & Seaquist, (2008) reported the increased frequency of cognitive domains in subjects of type 2 DM. Holdnacket al., 2011, also estimated the cognition impairment that was relationship with type2 DM. in their research determined the relation of type2 DM and cognition between women had reduced scores of cognitive domains and type 2 DM.

The participants sample havingT2DM with various ages and individual had a various conditions like diabetes duration, treatment and diabetic condition management such as dietetic input, medication types and usual exercise. The participants were control their level of Hba1c within optimum level and other conditions should be elucidated rigorously (Collins et al., 009).

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 table-4 showed the link among the evaluation of the premorbid functioning tests and cognitive tests. The area of cognitive functioning was estimated by the comparison of participant's TOPF performance and scores of cognitive tests. The observed optimal ability of the participants was mostly in average levels and also the samples were split into equal half. The optimal ability of diabetes subjects were compared to the normal healthy subjects, the TOPF scores of Hba1c or cholesterol and any demographics showed the strong measure in the sample.

The test for optimal ability does not usually used in the diabetes and cognitive function, the scores in the domain include in the tests (Hewitt et al., 2011). The tests showed no significant impairment of optimal ability. In the sample, the estimation of premorbid ability was variable in the use of TOPF and most of the participants grasp to prognostic power. For some of the participants it appears as a indicator to TOPF score. Due to the small sample the mass variables within the sample but not statistically controlled and it would be difficult.

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. In the case level the distribution observed was varied and difficult to determine the pattern of cognitive test scores and diabetes variables. In this study, the participants individual data examination does not showed the relative pattern of reduced cognitive domains at the groups level include in attention and processing speed.

The first participant was aged at 51 and a male he was self-employed. He spoke English as second language and he was originated from Tamilnadu. He was identified with the diabetics in December 2015 and also he had feet ulceration for he see a chiropodist at the hospital. He maintained a diet and doing exercises and had no intake of medicine for diabetes. This participant observed the overall strongest profile with relative strengths in subtest of Digits Forward, verbal attention and EF particularly subtest of Category Fluency. And weak in domain of learning and memory like subtest of visual immediate (Table-1). But, TOPF does not showed a good in his optimal ability compared to other scores.

Table-1: Scaled test scores for first participant

OPTIMALABILITY	**VERBAL ATTENTION**				**PROCESSING SPEED**						**EXECUTIVE FUNCTION**							**LEARNING & MEMORY**				**VERBAL & VISUO SPATIAL**	
TOPF	DIGITS FOR WA	DIGITSBACKW	DIGITSEQUEN	DIGITSPAN	COLOURNAM	WORDREADI	VISUALSCANN	NUMBERSEQ	LETTERSEQQ	DIGITSYMB	LETTER FLUENCY	CAT FLUEN	SWITCH OUTP	SWITCH ACCUR	INBITION	INHIBSWITCH	N-LSWITCH	STORYIMMED	STORY DELAY	VISUALIMM	VISUAL DELAY	SIMILARITIES	BLOCK DESIGN

	RD	ARD	CING		ING	NG	ING			OL		CY	UT	ACY		ING			ED	ED	ED		
12.0	18.2	16.1	11.2	16.0	12.0	14.0	13.0	13.2	14.3	13.1	15.2	18.3	16.1	15.2	14.0	12.1	11.4	8.2	6.5	4.6	8.0	10.5	11.2

The tests for executive function were used in the previous reviews. Moreover, it is foremost to allow the selected tests carefully; chosen tests were different and form different results. The TOPF, WAIS-IV and WMS-III are correlated each other that the sample norms were obtained from the test-takers of sample (Wong et al., 2014). This evolved much valuable and dependable test scores and keeps away the norms from the equivalent test populations. There was a reputation in the co-norms of the tests.

The second participant was aged at 49 and she was a female participant. She was un-employed and she finished her education at college level. She was affected by diabetes during 2003. This participant's score levels were average and her profile was mixed overall. The participant was relative strong in EF like subtest of Switch Accuracy and weakness in speed processing, tests for Sequencing and Letter Sequencing. The processing speed was reduced compared to other domains and optimal ability was useful score of the tests (Table-2). This denotes that participants before proficient to the domains of EF. Otherwise, the participants who were able to sort out the testing may be self-selection and know the awareness and motivation of an assessment. In some of the earlier findings the cholesterol increased levels can affect the tests of memory scores (Schreurs , 2010).

Table-2: Scaled test scores for second participant

OPTIMAL ABILITY	**VERBAL ATTENTION**				**PROCESSING SPEED**						**EXECUTIVE FUNCTION**							**LEARNING & MEMORY**				**VERBAL & VISUO SPATIAL**	
TOPF	DIGITS FORWA	DIGITSBAC	DIGITSEQU	DIGITSP	COLOURNAM	WORDREADI	VISUALSCA	NUMBERS	LETTERSE	DIGITSYMB	LETTERFLUENCY	CATFLUEN	SWITCHOUTP	SWITCHACCU	INBIBITI	INHIBSWIT	N-LSWIT	STORYIMM	STORYDELA	VISUALIMM	VISUALDELAY	SIMILARITIES	BLOCK DESIGN

	RD	KWARD	ENCING	AN	ING	NG	NNING	EQ	QQ	OL		CY	UT	RACY	ON	CHING	CH	ED	YED	ED	ED		
12.0	8.0	10.2	11.4	8.3	4.5	8.0	7.5	2.0	2.0	6.5	6.0	11.1	12.3	13.0	11.6	10.8	8.0	10.0	10.0	12.0	10.2	10.2	11.5

The third participant was a male and 45 year old. He was worked as a chess coach and well educated up to degree. He was diagnosed with diabetes in 2016 and he had a therapy for retinopathy with the help of consultant and nurse. This participant showed the relative impairment in the optimal ability on his scores of tests. He showed the increased score of TOPF than the premorbid functioning and also strong relative scores on executive function includes Letter Fluency and Category Fluency. There was a reduced score in the subtests of Inhibition and Inhibition Switching. Also decreased score noted on visuo-spatial construction test and Block Design (Table-3). Overall this participant had an average profiles with diabetes and affected cognition. In the research area, many of the participants have the good executive function and it could be suitable for the specific group in the sample. For example, the participants were able to come in time for testing within their work commitments mainly the employed participants and there were a only one has a issue during the recruitment process.

Table-3: Scaled test scores for third participant

OPTIMAL ABILITY	**VERBAL ATTENTION**					**PROCESSING SPEED**						**EXECUTIVE FUNCTION**							**LEARNING & MEMORY**				**VERBAL & VISUO SPATIAL**	
TOPF	DIGITS FORWARD	DIGITSBACK	DIGITSEQUE	DIGITSPAN	COLOURNAM	WORDREADI	VISUALSCAN	NUMBERSEQ	LETTERSE	DIGITSYMB	LETTERFLUENCY	CATFLUEN	SWITCHOUTP	SWITCHACCUR	INBITI	INHIBSWITC	N-LSWITCH	STORYIMM	STORYDELAY	VISUALIMM	VISUALDELAY	SIMILARITIES	BLOCKDESIGN

		WARD	NCING		ING	NG	NING		QQ	OL		CY	UT	ACY	ON	HING		ED	ED	ED	ED		
12.2	6.3	9.5	9.7	8.2	6.0	6.4	8.6	9.3	10.5	9.2	15.0	15.0	12.5	13.1	8.2	8.5	10.0	12.1	10.1	11.4	12.3	11.2	7.0

The participant four was aged at 54 old and a male. He was a painter and doing decoration works and educated in school level only up to the age 15. He had diabetes in 2007. He had lower relative domains in verbal & visuospatial skills. He was strong relative on speed processing like Visual Scanning, Digit Span Forward and Digit Span Sequencing; Number Sequencing, Letter Sequencing and Digit Symbol Coding; executive function includes Category Fluency, Switch Output and Accuracy and Inhibition Switching; Story Immediate and Story Delayed; verbal learning and memory. It was not considered as typical profile with T2DM (Table-4).

Table-4: Scaled test scores for fourth participant

OPTIMAL ABILITY	**VERBAL ATTENTION**				**PROCESSING SPEED**						**EXECUTIVE FUNCTION**							**LEARNING & MEMORY**				**VERBAL & VISUO SPATIAL**	
TOPF	DIGITS FORWARD	DIGITS BACKWARD	DIGITS SEQUENCI	DIGITS PAN	COLOURNAMING	WORDREADING	VISUALSCANNING	NUMBERSEQ	LETTERSEQQ	DIGITSYMBOL	LETTERFLUENCY	CATFLUENCY	SWITCHOUTPUT	SWITCHACCURACY	INBITION	INHIBSWITCHING	N-LSWITCH	STORYIMMED	STORYDELAYED	VISUALIMMED	VISUALDELAYED	SIMILARITIES	BLOCK DESIGN

			NG																			
7.1	11.3	7.3	11.9	9.1	7.0	9.1	12.3	13.0	11.0	12.0	8.1	14.2	18.5	17.9	12.1	13.1	9.2	12.5	13.4	8.6	10.5	6.2	6.3

The fifth participant was a female 55 years old and worked as a medical secretary and well educated. She was observed diabetes during 2001. She had a strong relative in subtest of Digits Forward and executive function test especially in Letter Fluency. Relative weakness observed in processing speed and immediate memory. Her relative scores equal to optimal ability and TOPF. She had reduced processing speed because of the variables in the domains (Table-5).

Table-5: Scaled test scores for fifth participant

OPTIMAL ABILITY	**VERBAL ATTENTION**				**PROCESSING SPEED**						**EXECUTIVE FUNCTION**							**LEARNING & MEMORY**				**VERBAL & VISUO SPATIAL**	
TOPF	DIGITS FORWARD	DIGITS BACKWARD	DIGITS SEQUENCING	DIGITS SPAN	COLOUR NAMING	WORD READING	VISUAL SCANNING	NUMBER SEQ	LETTER SEQQ	DIGITSYMBOL	LETTER FLUENCY	CATFLUENCY	SWITCHOUTPUT	SWITCHACCURACY	INBITION	INHIBSWITCHING	N-LSWITCH	STORYIMMED	STORYDELAYED	VISUALIMMED	VISUALDELAYED	SIMILARITIES	BLOCK DESIGN
10.1	17.3	12	10	14	12.2	11	10	12	12	9.0	19.5	17	17.2	16.1	13	13	11	8.5	11.0	13	14.7	10.0	10.0

		.2	.5	.1		.5	.6	.1	.0			.4			.2	.0	.1			.7			

Table-6: Scaled test scores for sixth participant

OPTIMAL ABILITY	VERBAL ATTENTION				PROCESSING SPEED						EXECUTIVE FUNCTION							LEARNING & MEMORY				VERBAL & VISUO SPATIAL	
TOPF	DIGITS FORWARD	DIGITS BACKWARD	DIGITS SEQUENCING	DIGITSPAN	COLOURNAMING	WORDREADING	VISUALSCANNING	NUMBERSEQ	LETTERSEQQ	DIGITSYMBOL	LETTERFLUENCY	CATFLUENCY	SWITCHOUTPUT	SWITCHACCURACY	INBITION	INHIBSWITCH	N-LSWITCH	STORYIMMED	STORYDELAYED	VISUALIMMED	VISUALDELAYED	SIMILARITIES	BLOCK DESIGN
4.6	6.5	6.6	5.0	4.2	7.1	3.6	10.7	5.0	5.3	6.1	3.2	6.1	8.2	9.3	5.2	1.5	3.6	10.5	10.1	6.1	6.0	2.5	9.2

Sixth participant was 35 year and educated up to college. She was searching for a job. She had presence of diabetes in 2015. She had a poor profile range and very lower optimal ability score. Impaired scores were observed in tests like executive function, Letter Fluency, Inhibition Switching and Number-Letter Switching, and in verbal construction, Similarities. For test of processing speed, Visual Scanning, tests of learning and memory, specifically for Story Immediate and Story Delayed, executive function in the Switch Accuracy subtest, and visuo-spatial construction, in Block Design she had a well score only. Due to the fractured in the skull at the age of her five and she had diagnosed with dyslexia in her childhood. So she seems to detectable pattern for both strong and weakness for domains. For the time of testing she was experienced enumerate and long.

The investigation of the variable domains with the all participants caused a variety of potential impact of diabetes related indicators and tested participant's patterns. The average level or reduced level of TOPF, but had different relative score tests crossed the level of subtests. Accordingly, the TOPF scores not a valuable test to estimate the possible reduction of T2DM.

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. Some correlation among the health markers linked to the diabetes and cognition in the expected way like attention, executive function, construction of visuo-spatial and learning and memory and learning and memory and construction of verbal-spatial. There was a development among the executive function test and optimal ability that were depends on the past literatures.

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