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Executive Functioning And Self-Management Among People With Type 2 Diabetes

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Abstract

Diabetes is a growing public health concern, increasing in prevalence and eroding quality of life and burdening the healthcare system. It is a major risk factor for cognitive decline. Maintaining good glycaemic control, which can be achieved by self-management, can help to prevent or delay diabetes complications. The ability to carry out self-management tasks requires the use of a variety of cognitive skills. But decline in cognitive functions, as literature shows, can hinder these tasks and might pose new challenges to diabetes self-management and glycaemic control. In light of this, the present study aims to examine the relationship between executive functioning and self-management among people with type 2 diabetes. The study was conducted on a sample of 100 diabetic and 70 non-diabetic control participants with the age range of 40 to 60 years, purposely drawn from the Department of Endocrinology and Metabolism, Sir Sundarlal Hospital, BHU, Varanasi (UP).The study was approved by the Ethical committee, IMS, BHU. The participants were administered the 'Demographic and Clinical Profile', the "Behaviour Rating Inventory of Executive Function (Adult-A)-Self-Report Form" and the "Diabetes Self-Management Questionnaire". The result revealed significant differences in executive functioning between diabetic and non-diabetic control groups, as well as a strong negative relationship between executive functioning and diabetes self-management among people with type 2 diabetes.

Keywords: Diabetes, Quality of Life, diabetes complications, Executive functioning, Self-Management, glycaemic control.

Introduction

Executive function, an important component of cognitive function, has been the focus of much research in recent years, given its close relationship with chronic non-infectious diseases (Perry et al., 2019). Cognitive function encompasses all aspects of intellectual and thinking activities, including reasoning, memory, attention, language, and information processing, all of which are essential for everyday activities (Huang et al., 2016). Executive function is a broad term that encompasses a wide range of cognitive processes and behavioral competencies to facilitate the initiation, planning, regulation, sequencing, and achievement of complex goal-oriented behavior and thought (Shallice 1989; Stuss & Benson 1986; Royall, Lauterbach, Cummings, Reeve, Rummans, Kaufer, LaFrance & Coffey, 2002). Executive functions are divided into two primary domains that assess related but distinct factors. These are behavioral regulation and metacognition. Behavioral regulation is defined as the ability to inhibit, shift, and sustain emotional control. Metacognition is defined as the ability to initiate, plan, organize, monitor, and working memory (Gioia et al., 2000). It is found in studies that chronic diseases such as diabetes mellitus impair executive functions (Zhao, Zhang, Liao & Wang, 2020). Wateri, et al. (2006) found that diabetic and non-diabetic groups differed significantly in executive functioning.

Diabetes mellitus is a metabolic disease and has become a major public health challenge worldwide. Diabetes management is an important step in preventing or delaying the onset of diabetes complications (Heisler, Vijan, Anderson, Ubel, Bernstein & Hofer, 2003; Krapek, King, Warren, George, Caputo & Mihelich, 2004; Pladevall, Williams, Potts, Divine, Xi & Lafata, 2004). Diabetes management is closely related to health behavior and can be controlled by self-management, which involves checking and interpreting blood glucose levels, regulating nutrition, following an appropriate exercise regimen, taking medication as prescribed by a doctor, calculating insulin dosage, remembering to bring supplies, and attending regular follow-up appointments. In order to carry out these behaviors effectively, executive functions like planning and initiating actions, organizing materials, regulating impulses, and changing attention are often required. But as diabetes progresses, executive functioning deteriorates dramatically which further exacerbates symptoms. Both hyperglycemia and hypoglycemia significantly impairs executive functioning in people of all ages with type 1 and type 2 diabetes mellitus. Surprisingly, a decline in executive functioning contributes to the progression of diabetes. In a vicious cycle, glucose dysregulation and executive function decline exacerbate each other: poor blood glucose control, impaired executive function, diabetes management task failure, and then back to poor blood glucose control. (Zhao et.al. 2020). Hence, the demands of treating diabetes while living with cognitive dysfunction provide extra problems for both service users and healthcare providers. In a study, Sinclair, Girling & Bayer (2000) found that subjects with a lower cognitive score were less involved in diabetes self-management practices, required significantly more assistance with personal care behavior, and were more likely to have been hospitalized in the previous year. Similar findings were also reported by Feil, Zhu & Sultzer (2012) in their study, who opined that participants with poor executive functions were poor in exercise and diet.

Despite this, little study has been done on diabetic people with cognitive dysfunction and the challenges they have in managing their diabetes, as well as their perceived barriers and facilitators to successful diabetes self-management. Although many researchers have looked at cognition in diabetes and self-management in diabetes, few have looked at the effects of changes in cognition on self-management. The consequences of cognitive dysfunction on health behaviors are also not taken into consideration in most chronically ill patient health behavioral models (Hall et al., 2006), and the association between specific diabetes self-management activities and cognitive dysfunction is not fully investigated. Although some studies on type 2 diabetes self-management speculate that cognitive impairment may impede people's self-management efforts, as well as the idea that cognitive skills such as problem solving may be particularly relevant in diabetes self-management (Glasgow, 1991; Sullivan & Joseph, 1998), no systematic research has looked into whether there is a link between cognitive functioning and diabetes self-management. Furthermore, this link has not been investigated in a larger population-based sample using recently validated measurements. (Feil, Zhu, & Sultzer, 2012). As a result, considerably more empirically valid studies are required in this field.

In view of the above, the present study was conducted to examine the impact of diabetes on executive functioning and to find out whether any change in executive functioning seen among people with type 2 diabetes affects the ability to self-manage the condition.

Objectives

In view of the gaps in the existing literature, the present study was conducted to address the following objectives:

1. To assess executive functioning among people with type 2 diabetes.
2. To examine the relationship between executive functioning and self-management among people with type 2 diabetes.

Hypotheses

On the basis of the literatures, following hypotheses were formulated:

H1 (a): There would be significant differences between diabetic and non-diabetic groups in global executive functioning.

H1 (b): Diabetic and non-diabetic groups would differ significantly in the behavioral regulation domain of executive functioning.

H1(c): Diabetic and non-diabetic groups would differ significantly in the metacognition domain of executive functioning.

H2 (a): There would be negative relationship between global executive functioning and self-management among people with type 2 diabetes.

H2 (b): There would be negative relationship between the behavioral regulation domain of executive functioning and self-management among people with type 2 diabetes.

H2(c): There would be negative relationship between the metacognition domain of executive functioning and self-management among people with type 2 diabetes.

Method

Sample

The study was conducted on a sample of 170 participants from rural and urban areas with the age range of 40 to 60 years. The sample was divided into two groups: Group 1 and Group 2. Group 1 consisted of 100 participants diagnosed with type 2 diabetes. Group 2 consisted of 70 non-diabetic control participants matched on demographic variables. The sample was drawn from the Department of Endocrinology & Metabolism, Sir Sundarlal Hospital, IMS, BHU, Varanasi. To ensure sample homogeneity, efforts were made to match both groups on demographic and socioeconomic variables to the greatest extent possible. Written informed consent was taken from the participants and the study was approved by the ethical committee IMS, BHU.

The exclusion criteria of the sample were: illiterate people; history of psychiatric and neurotic diseases; any coexisting neurological disease; severe sensory handicap; any history of past/current substance abuse/dependence; documented history of head trauma; mental retardation; an established diagnosis of dementia or a memory disorder; those needing an interpreter; and any other medical/endocrinal disorder except diabetes mellitus. Inclusion criteria were: literate type 2 diabetic people with an age range of 40 to 60 years; a diagnosis of type 2 diabetes for at least 1 year by a diabetes consultant; and non-diabetic normal control participants with an age range of 40 to 60 years. A purposive sampling method was adopted in the selection of the participants.

Tools

The Demographics and Clinical Profile

The demographic and clinical characteristics profile was prepared by the researcher. It contains questions about age, gender, years of formal education, employment status, marital status, duration of diagnosis, and monthly income of the family. Other information about diabetes-related complications such as retinopathy, heart disease, dyslipidemia, and information related to a previous history of depression, dementia, Parkinson's disease, and stroke.

Behaviour Rating Inventory of Executive Function (Adult-A)-Self-report Form (Roth, Isquith & Gioia, 2005)

The Behaviour Rating Inventory of Executive Function (Adult-A)-Self-Report Form was used to measure the executive function of the participants. This is a standardized rating scale developed to provide a window into everyday behaviors associated with specific domains of the executive functions in adults ages 18 to 90 years. It consists of 75 items rated on a three-point Likert type scale, ranging from 1 (Never) to 3 (often). Higher scores indicate poor executive function. BRIEF-A has 75 items in nine non-overlapping scales, as well as two summary index scales and a scale reflecting overall functioning. The Behavioral Regulation Index (BRI) is composed of four scales: Inhibit, Shift, Emotional Control, and Self-Monitor. The Metacognition Index is composed of five scales: Initiate, Working Memory, Plan/Organize, Task Monitor, and Organization of Materials.

This scale was translated from English to Hindi language by using the translation back translation method (Brislin, 1970). Cronbach's alpha of the scale by the researcher was found to be 0.95. To ascertain the validity, content validity and face validity were ensured through expert judgments.

Diabetes Self-Management Questionnaire (Schmitt, 2013)

The DSMQ, developed by Schmitt (2013), was used to measure the self-management behavior of the participants. This is a 4-point Likert type scale consisting of 16-items which assess four dimensions of self-care, viz., "glucose management" (GM), "dietary control" (DC), "physical activity" (PA), "health-care use" (HU) as well as a "sum scale". The DSMQ contains 7 positively and 9 negatively (resp. inversely) worded items. The inverse items have to be recoded such that higher values indicate more effective self-care before summing item scores to scale scores. Overall, Cronbach's alpha of the scale is 0.84 (Schmitt, 2013).

This scale was translated from English to Hindi language by using the translation back translation method (Brislin, 1970). Cronbach's alpha of the scale by the researcher was found to be 0.76. To ascertain the validity, content validity and face validity were ensured through expert judgments.

Results

For data analysis, the SPSS Version 20 (Statistical Packages for Social Science) software was used. The differences in executive functioning and its domains between diabetic and non-diabetic control groups were examined using the mean, standard deviation, and t-test. The Pearson's correlation coefficient was used to examine the relationship between the predictor variable (executive functioning) and the criterion variable (self-management). Hierarchical regression analysis was used to examine the relative contributions of each predictor variable, accounting for the unique variance above and beyond the variance explained by other variables in the prediction of criterion variables. In each set of hierarchical regression analyses, the demographic variables were entered in the first step of the regression equation to partial out their effects prior to entering the predictor variables. In the second step of the equation, each predictor variable was added one by one. The results are presented accordingly-

Table 1: Mean, Standard Deviation and t-ratio of diabetic and non-diabetic control groups on Behavioral regulation index, Metacognition Index and Global Executive functioning.

Variables	Diabetic group (N=100)		Non-diabetic control group (N=70)		t-ratio
	Mean	S.D.	Mean	S.D.	
Behavioral regulation index	55.80	12.34	52.20	8.27	2.276*
Metacognition index	70.12	15.56	66.51	11.16	1.759
Global executive functioning (Behavioral regulation index + Metacognition index	134.42	28.58	126.75	19.14	2.093*

The mean scores of diabetic and non-diabetic control participants on total behavioral regulation index were 55.80 and 52.20 respectively. The mean score of diabetic people were significantly higher (t= 2.276, p<0.05) than that of non-diabetic controls.

Therefore, the H1 (b) that diabetic and non-diabetic groups would differ significantly in behavioral regulation is, supported.

The mean scores of diabetic and non-diabetic control participants on total metacognition index were found to be 70.12 and 66.51 respectively. The difference between the groups was not found to be significant (t=1.759, NS).

Therefore, H1(c) that diabetic and non-diabetic groups would differ significantly in metacognition is, not supported.

The mean scores of diabetic and non-diabetic control participants on global executive functioning were found to be 134.42 and 126.75 respectively. The mean score of diabetic people were significantly higher (t=2.093, p<0.05) than that of non-diabetic controls.

Therefore, the H1 (a) that there would be significant difference between diabetic and non-diabetic groups in global executive functioning is, supported.

Table 2: Correlation between Behavioral regulation and Self-management among people with type 2 diabetes

Predictor Variables	Criterion variables					
	Glucose management	**Dietary control**	**Physical activity**	**Health care use**	**Sum scale**	**Overall Self-management**
Inhibit	-.394**	-.356**	-.357**	-.234*	-.253*	-.477**
Shift	-.292**	-.233*	-.297**	-.195	-.241*	-.367**
Emotional control	-.396**	-.331**	-.345**	-.157	-.193	-.439**
Self-monitor	-.353**	-.254*	-.212*	-.221*	-.162	-.364**
Total Behavioral regulation	-.422**	-.349**	-.361**	-.228*	-.246*	-.485**

**p<0.01, *p<0.05

A perusal of table-2 shows that total behavioral regulation has significant negative correlation with overall self-management (r= -.485, p<0.01) and its all dimensions namely, glucose management (r= -.422, p<0.01), dietary control (r= -.349, p<0.01), physical activity (r= -.361, p<0.01) health care use (r = -.228, p<0.05) and sum scale (r= -.246, p<0.05). It is also obvious from the table that glucose management, dietary control and physical activity have significant negative correlation with all dimensions of behavioral regulation index. Health care use has significant negative correlation with all dimensions of behavioral regulation index except shift and emotional control. Table shows that sum scale also correlated significantly and negatively with all dimensions of behavioral regulation but not with emotional control and self-monitor.

Table 3: Summary of hierarchical regression analysis for Behavioral regulation as predictor and Self-management as criterion among people with type 2 diabetes

Demographic variables	Criterion variables (Self-management)											
	Glucose management		**Dietary control**		**Physical activity**		**Health care use**		**Sum scale**		**Overall Self-management**	
	Step1	**Step 2**	**Step1**	**Step 2**	**Step1**	**Step2**	**Step1**	**Step2**	**Step 1**	**Step2**	**Step 1**	**Step2**

Age	.133	.080	-.059	-.110	.068	.019	.342	.319	.178	.146	.161	.098
Education	.125	.070	-.088	-.141	.019	-.031	.098	.074	-.079	-.112	.039	-.027
Locale	-.013	.026	.100	.138	-.051	-.015	-.014	.003	-.110	-.087	-.008	.038
Duration of diabetes	-.058	.000	-.029	.027	.085	.138	-.163	-.138	.031	.065	-.037	.031
Predictor variable (Behavioral regulation)												
β		**-.408*****		**-.394*****		**-.375*****		**-.178**		**-.244***		**-.486*****
Overall R^2	.032	.190	.024	.171	.019	.152	.115	.145	.054	.110	.025	.249
R^2 change	.032	.158	.024	.147	.019	.133	.115	.030	.054	.057	.025	.224
F	.791	4.417***	.578	3.870**	.455	3.364**	3.086*	3.187*	1.350	2.334*	.614	6.244***

*p<0.05, **p<0.01, ***p<0.001 df1 and 2 (step-1) – 4, 95 df1 and 2 (step-2) - 1, 94

It is apparent from Table-3 that behavioral regulation accounted for 22.4% of variance in the explanation of overall self-management (R^2 change = .224, F (1, 94) = 6.244, p<0.001), 15.8 % variance in the explanation of glucose management (R^2 change =.158, F (1, 94) = 4.417, p<0.001), 14.7 % variance in the explanation of dietary control (R^2 change =.147, F (1, 94) = 3.870, p<0.01), 13.3 % variance in the explanation of physical activity (R^2 change =.133, F (1, 94) = 3.364, p<0.01), 03.0 % variance in the explanation of health-care use (R^2 change =.030, F (1, 94) = 3.187, p< 0.05) and 05.7 % variance in the explanation of sum scale (R^2 change =.057, F (1, 94) = 2.334, p< 0.05) over and above the demographic variables. Overall the results indicated that behavioral regulation significantly and negatively predicted glucose management (β= -.408, p<0.001), dietary control (β=-.394, p<0.001), physical activity (β= -.375, p<0.001), sum scale (β= -.244, p<0.05) and overall self-management (β= -.486, p<0.001) except health-care use (β= -.178, NS) which was not found to be significant.

Therefore, H2 (b) that there would be negative relationship between behavioral regulation and self-management among people with type 2 diabetes is, supported.

Table-4: Correlation between Metacognition and Self-management among people with type 2 diabetes

Predictor variables	Criterion variables					
	Glucose management	**Dietary control**	**Physical activity**	**Health care use**	**Sum scale**	**Overall Self-management**
Initiate	-.327**	-.297**	-.337**	-.264**	-.317**	-.443**
Working memory	-.362**	-.344**	-.391**	-.196	-.246*	-.463**
Plan/organize	-.409**	-.331**	-.293**	-.263**	-.263**	-.461**
Task monitor	-.452**	-.401**	-.345**	-.149	-.261**	-.490**
Organization of material	-.305**	-.333**	-.287**	-.231*	-.254*	-.412**
Total Metacognition	-.425**	-.391**	-.380**	-.261**	-.310**	-.523**
Global Executive functioning (Behavioral regulation + Metacognition)	-.428**	-.378**	-.381**	-.248*	-.283**	**-.513****

**p<0.01, *p<0.05

A perusal of table-4 shows that total metacognition correlated significantly and negatively with overall self-management (r= -.523, p<0.01) and its all dimensions namely, glucose management (r= -.425, p<0.01), dietary control (r= -.391, p<0.01), physical activity (r= -.380, p<0.01) health care use (r = -.261, p<0.01) and sum scale (r= -.310, p<0.01). It is also apparent from the table that glucose management, dietary control, physical activity and sum scale have significant negative correlation with all dimensions of metacognition. Health care use has significant negative correlation with all dimensions of metacognition but not with working memory and task monitor. Global executive functioning was also correlated significantly and negatively with overall self-management and its all domain.

Table 5: Summary of hierarchical regression analysis for Metacognition as predictor and Self-management as criterion among people with type 2 diabetes

Demographic variables	**Criterion variables (Self-management)**											
	Glucose management		**Dietary control**		**Physical activity**		**Health care use**		**Sum scale**		**Overall Self-management**	
	Step 1	**Step 2**	**Step1**	**Step2**	**Step1**	**Step2**	**Step1**	**Step2**	**Step 1**	**Step2**	**Step1**	**Step 2**
Age	.133	.076	-.059	-.121	.068	.012	.342	.313	.178	.134	.161	.088
Education	.125	.048	-.088	-.173	.019	-.056	.098	.059	-.079	-.139	.039	-.061
Locale	-.013	.032	.100	.150	-.051	-.007	-.014	.008	-.110	-.075	-.008	.050
Duration of diabetes	-.058	.011	-.029	.047	.085	.152	-.163	-.128	.031	.085	-.037	.052
Predictor variable (Metacognition)												
β		**-.415*****		**-.456*****		**-.405*****		**-.209***		**-.323****		**-.537*****
Overall R^2	.032	.191	.024	.216	.019	.170	.115	.155	.054	.150	0.25	.292
R^2 change	.032	.159	.024	.192	.019	.151	.115	.040	.054	.096	.025	.267
F	.791	4.440***	.578	5.171***	.455	3.846**	3.086	3.461**	1.350	3.321**	.614	7.746***

*p<0.05, **p<0.01, ***p<0.001 df1 and 2 (step-1) – 4, 95 df1 and 2 (step-2) - 1, 94

It is apparent from Table-5 that metacognition accounted for 26.7 % of variance in the explanation of overall self-management (R^2 change = .267, F (1, 94) = 7.746, p<0.001), 15.9 % variance in the explanation of glucose management (R^2 change =.159, F (1, 94) = 4.440, p<0.001), 19.2 % variance in the explanation of dietary control (R^2 change =.192, F (1, 94) = 3.5.171, p<0.001), 15.1 % variance in the explanation of physical activity (R^2 change =.151, F (1, 94) = 3.846, p<0.01), 04.0 % variance in the explanation of health-care use (R^2 change =.040, F (1, 94) = 3.461, p< 0.01) and 09.6 % variance in the explanation of sum scale (R^2 change =.096, F (1, 94) = 3.321, p< 0.05) over and above the demographic variables. Overall the results indicated that metacognition significantly and negatively predicted glucose management (β= -.415, p<0.001), dietary control (β=-.456, p<0.001), physical activity (β= -.405, p<0.001), health care use (β= -.209, p<0.05), sum scale (β= -.323, p<0.01) and overall self-management (β= -.537, p<0.001).

Therefore, H2(c) that there would be negative relationship between metacognition and self-management among people with type 2 diabetes is, supported.

Table-6: Summary of hierarchical regression analysis for Global Executive functioning as predictor and Self-management as criterion among people with type 2 diabetes

Demographic variables	Criterion variables (Self-management)											
	Glucose management		Dietary control		Physical activity		Health care use		Sum scale		Overall Self-management	
	Step1	Step2	Step 1	Step2	Step 1	Step 2	Step 1	Step 2	Step1	Step 2	Step1	Step2
Age	.133	.076	-.059	-.118	.068	.013	.342	.315	.178	.139	.161	.090
Education	.125	.057	-.088	-.160	.019	-.047	.098	.066	-.079	-.126	.039	-.047
Locale	-.013	.033	.100	.147	-.051	-.007	-.014	.007	-.110	-.079	-.008	.049
Duration of diabetes	-.058	.008	-.029	.041	.085	.149	-.163	-.132	.031	.077	-.037	.045
Predictor variable (Global executive functioning)												

β		**-.416*****		**-.436*****		**-.402*****		**-.196***		**-.289****		**-.523*****
Overall R^2	.032	.194	.024	.201	.019	.169	.115	.151	.054	.131	.025	.280
R^2 change	.032	.162	.024	.177	.019	.151	.115	.036	.054	.078	.025	.255
F	.791	4.519***	.578	4.720***	.455	3.835**	3.086	3.342**	1.350	2.846*	.614	7.308***

*p<0.05, **p<0.01, ***p<0.001 df1 and 2 (step-1) – 4, 95 df1 and 2 (step-2) - 1, 94

It is quite apparent from Table-6 that global executive functioning accounted for 25.5% of variance in the explanation of overall self-management (R^2 change = .252, F (1, 94) = 7.308, p<0.001), 16.2% variance in the explanation of glucose management (R^2 change =.162, F (1, 94) = 4.519, p<0.001), 17.7% variance in the explanation of dietary control (R^2 change =.177, F (1, 94) = 4.720, p<0.001), 15.1% variance in the explanation of physical activity (R^2 change =.151, F (1, 94) = 3.835, p<0.01), 3.6% variance in the explanation of health-care use (R^2 change =.036, F (1, 94) = 3.342, p< 0.01) and 7.8% variance in the explanation of sum scale (R^2 change =.078, F (1, 94) = 2.846, p< 0.05) over and above the demographic variables. Overall the results indicated that global executive functioning significantly and negatively predicted glucose management (β= -.416, p<0.001), dietary control (β=-.436, p<0.001), physical activity (β= -.402, p<0.001), health-care use (β= -.196, p<0.001) sum scale (β= -.289, p<0.001) and overall self-management (β= -.523, p<0.001).

Therefore, H2 (a) that there would be negative relationship between global executive functioning and self-management among people with type 2 diabetes is, supported.

Discussion

The analyses of the data revealed that diabetic and non-diabetic groups differed significantly in global executive functions and behavioral regulation domains of executive function (shift, emotional control except inhibit, self-monitor). In other words, the diabetes group performed worse in global executive functions as well as the behavioral regulation domain of executive function than the non-diabetic control group. Contrary to our prediction, both the groups didn't differ significantly in the metacognition domain of executive function (initiate, working memory, plan/organize, and task monitor except for the organization of material). Previous studies also show the similar findings related to significant differences between diabetic and non-diabetic group in executive functioning and its domains (Zhao, Zhang, Liao & Wang, 2020). Wateri et al. (2006) found that diabetic and non-diabetic groups differed significantly in executive functioning.

As predicted, a significant negative relationship was also obtained between the behavioral regulation domain of executive functioning and the self-management of people with type 2 diabetes. Key components of behavioral regulation such as abilities to inhibit, shift, sustain emotional control, and self-monitor were also found to be significantly negatively correlated with self-management among type 2 diabetics (Result table-2). People who scored high on the behavioral regulation index, scored low on the measures of self-management. The result of the hierarchical regression analysis revealed that behavioral regulation also significantly predicts diabetes self-management (Result table-3). Those with worse behavioral regulation had overall poor self-management in comparison to those with better behavioral regulation.

The metacognition domain of executive functioning (abilities to initiate, plan, organize, monitor, and working memory) was also found to be significantly negatively correlated with diabetes self-management (Result table-4). The result of the hierarchical regression analysis revealed that metacognition significantly predicts self-management of type 2 diabetic people. Better the metacognition, better the self-management was found (Result table-5). This finding is inconsistent with the findings of Miller et al. (2013), in which it was found that the metacognition domain of executive function did not predict diabetes self-management.

As results tables 4 and 6 revealed, global executive functioning was found to be significantly negatively correlated and predicted diabetes self-management. In other words, a higher score on the BRIEF-A scale reflects poor executive functioning, which further decreases diabetes self-management behavior. As a result, diabetics with poor executive functioning were less likely to perform certain self-management behaviors properly. The findings of the present study support the findings of Sinclair et al. (2000), who found that people with lower cognitive score were less involved in diabetes self-management practices, required significantly more assistance with personal care behaviors, and were more likely to have been hospitalized in the previous year. Similar findings were also reported by Feil et al. (2012) in their study, who opined that participants with poor executive functions were poor in exercise and diet.

A possible explanation for the above mentioned findings is that diabetes self-management requires a great deal of planning, organization, and problem solving for complex goal-directed health behavior. But diabetic people with more limited executive functioning skills may be more likely to have difficulty with diabetes self-management demands. Diabetes self-management requires insulin dose adjustment based on dietary intake, blood-glucose monitoring results, and activity level. Integrating and acting on information from multiple sources may be challenging for diabetic people with poor executive functioning. This is because diabetic complications extending to the central nervous system may have a deteriorating effect on mental health, including a decline in cognitive functioning. This could be a reason for depression, lack of compliance towards medication/treatment, and the inability of patients to meet the day-to-day management demands of the disease. Due to the high metabolic demand for energy in the brain, perturbations in glucose metabolism can noticeably impact cognitive performance (Aruoma, Narrain, Indelicato, Bourdon, Murad & Bahorun, 2014).

Conclusion

Type 2 diabetes is a risk factor for cognitive decline. It impairs executive functioning, which has a negative impact on diabetes self-management. Executive functioning and diabetes self-management have a significant negative relationship. If people with type 2 diabetes have poor executive functioning, he or she may be unable to conduct self-management tasks appropriately and his or her adherence to the diabetes regimen may suffer. Thus, executive functioning appeared to be a very important factor in maintaining goal-directed health behavior. Health psychologists should seek a better understanding of the factors that influence volitional behavior in order to identify targets for interventions that will result in greater adherence to health behaviors.

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