The Chittagong Univ. J. B. Sci.,Vol. 10(1 &2):191-199, 2020.

THE EFFECT OF DIABETES AND EDUCATION ON COGNITIVE FUNCTION OF OLDER PEOPLE

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ABSTRACT

The aim of present study was to investigate the effect of diabetes on cognitive impairment of older people in relation to literacy. Total 50 older people were purposively selected from Fotepur Union of Chittagong District. Among them 30 were literate and 20 were illiterate. In each group, diabetic and non-diabetic older participants were equally incorporated. WHO five wellbeing index (WHO-5) was used to measure participant's psychological well-being. To measure cognitive function, an adapted Bangla version of Mini Mental State Examination (BAMSE) was used. Two-way analysis of variance (ANOVA) was used to analyze data. Results revealed that diabetic older people have better cognitive function than non diabetic older adults. Secondly, education positively affects cognitive function of older people.

Keywords**:** Cognitive function, Diabetes, Older people

INTRODUCTION

Cognitive impairment (CI), inablity to function well in cognitive activities, is a crucial problem for successful aging. Successful aging is the absence of cognitive impairment as well as preservation of the multi-dimensional cognitive structure that allows the older adult to maintain social connectedness, and the abilities to function independently, to permit functional recovery from illness and injury, and to cope with residual cognitive deficits (Hendrie *et al.,* 2006). CI has emotional, physical and financial toll to family caregivers (CDC 2011). Delayed of this process can reduce the burden to their family. The family provides important resources that sustain the well-being of its members at every stages of the life-course.

CI deteriorates with aging and creates different health problems in old age. Old age is the last part of life and it is the period of life after youth and middle age.

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According to World Health Organization (WHO 1984) old age begins after 55 years. And aging is a persistent decline in the age-specific fitness components of an organism due to internal physiological and psychological degeneration (Baddeley 2002). Psychological ageing is a process that includes the changes in mental functioning, such as loses of memory, reduction of learning capacity, reasoning ability, problem solving capability, and decision making ability (Morgan and Kunkel 1998) which affect their daily activities. Thus, in this stage older people are unable to maintain daily activities due to cognitive changes. Besides, some disorder as well as chronic disorders such as diabetes (CDC 2011) is a risk factor for cognitive impairment. Diabetes is the chronic disorder of the endocrine system in which the body unable to manufacture or proper use of insulin. It is most common chronic illness in the world. Prevalence of the diabetic patient in Bangladesh is about 8.4 million (Desk 2015) and about 10% (Rahman *et al.,* 2015) of them are older people.

Chatterjee *et al.,* (2016) conducted a study on type 2 diabetic women patients and found that type 2 diabetic patient have more than 60% risk of developingthe cognitive dysfunction in women. Hazari *et al.,* (2015) conducted a research using event-related potential to find out the relation between duration of diabetes with decreased cognitive function and found that type 2 diabetes, more than 5 year duration, was associated with cognitive deficit. McCrimmon *et al.,* (2012) conducted a study on type 2 diabetic patients and found that in all ages, diabetes increase cognitive dysfunction. Wilson *et al.,* (2002) conducted a study on participation in cognitively stimulating activities and risk of incident Alzheimer disease and found in their study that diabetes mellitus is associated with an increased risk of developing Alzheimer disease (AD) and may affect cognitive systems differentially. Edward *et al.,* (2000) reported that diabetes could also contribute to the cognitive impairment among older women. They also added that women who had diabetes for more than 60 years had a 57% to 114% greater risk of major cognitive decline when compared with those women without diabetes.

Education is another factor that functions as a moderator of cognitive function (Lenehan *et al.,* 2015; Tripp and College 2005). Some researcher argued that there is a little even no relationship between cognitive decline and literacy (Sharrett 2012 , Zahodne *et al.,* 2011). Lamottea *et al.,* (2016) conducted study on Dementia with Lewy bodies and found higher education have a protective effect on specific cognitive functions, such as visual constructive performance and verbal retrieval strategies. Godbole *et al.,* (2016) conducted a study on elderly

people in India and found education as a mitigating factor for cognitive deficit. Sharrett (2012) found poor association between educational level and cognitive decline in the elderly people. Glymoure *et al.,* (2012) found in their research that the possible impacts of educational experiences on cognitive change are little and domain-specific. Zahodne *et al.,* (2011) conducted a longitudinal study on 1014 participants and found education to be related to cognitive performance but unrelated to cognitive decline. Baker *et al.,* (2006) found in their study that individuals with inadequate health literacy had worse physical function and mental health than individuals with adequate health literacy.

Above literature showed that diabetes type 2 and its duration are associated with cognitive dysfunction. It is also seen that literacy is positively associated with cognitive function in some specific domain. In another aspect, literacy is not associated with cognitive function. Contradictory finding arises here. It is also seen that most of the researches were done on older women. However, the cognitive function of diabetic older people of Bangladesh is less known. Thus, the aim of this study was to investigate the effect of diabetes on cognitive function in relation to education. It was also well known that education is related with better cognitive function but in case of diabetic patient, how these factors are related with cognitive function was not clearly understood. This study helped to understand the knowledge gap in this context. So it was theoretically as well as practically important to investigate the relation between diabetes and cognitive function with regards to education level in Bangladesh.

The objective of this study was to investigate the effect of diabetes and education on cognitive function of older people. To ensure the objective following hypothesis were framed-

H_1: Cognitive function of non diabetic older adult would be better than diabetic older adult;

H_2: Cognitive function of literate older adult would be better than illiterate older adult;

MATERIALS AND METHODS

Participants

68 older people were primarily selected purposively from the Fotepur Union of Chittagong District. Among them, only 50 older participants fulfill inclusion criteria and finally included in this study. 30 were literate and 20 were illiterate. In each group diabetic and non-diabetic older participant were equally included. Their average age was 69.32 years (Table 1).

TABLE 1: DISTRIBUTION OF SAMPLE ACCORDING TO EDUCATION LEVEL AND DIABETES

Education level		Diabetic Patient status		Total
		Diabetic	Non diabetic	
Illiterate		10	10	20
Literate	Primary	5	5	10
	SSC	5	5	10
	Bachelor	5	5	10
Total		25	25	50

Instruments Used

Adapted Bangla version of Mini-mental State Examination (BAMSE) (Kabir and Herlitz 2000) test was used in this study. It covers the person's orientation to time and place, recall ability, short-term memory, and arithmetic ability. Maximum score of this test is 30 and higher score indicates better cognitive function where as lower score indicate cognitive impairment. Any score greater than or equal to 24 points (out of 30) indicates a normal cognition. Below this, scores can indicate severe (≤ 9 points), moderate (10–18 points) or mild (19–23 points) cognitive impairment. The concurrent validity of the scale is r = 0.57 and test-retest reliability is r = 0.70. To screen participants WHO Five Wellbeing Index (WHO-5) was used and it measures their psychological well-being at the moment of taking test.

Design

Cross sectional survey design was used for present study.

Procedure

The respondents were contacted personally and their age was confirmed by their national ID card. After taking prior consent, their personal information was recorded and WHO (Five) Well-Being Index (Ware 1998) was applied to ensure their psychological well-being at that moment of collecting data. Finally, participants who scored higher than 12 in well-being test were included in this study and administered BAMSE to them with trained expert. They were tested individually and data were collected at one session in a quiet environment. After collection of data, they were inputted SPSS 16 and analyzed by two-way and one-way ANOVA.

RESULTS AND DISCUSSION

The aim of this study was to find out the effect of diabetes and literacy on cognitive function of older people. In order to analysis the effect, two-way analysis of variance (ANOVA) was done and summary of the ANOVA has been presented in table 2.

TABLE 2: SUMMARY OF ANOVA OF COGNITIVE FUNCTION (BAMES) SCORE ACCORDING TO DIABETES STATUS AND LITERACY STATUS

Source	*SS*	*df*	*MS*	*F*
Diabetes Status (A)	154.08	1	154.08	12.62*
Literacy Status(B)	302.00	1	302.00	24.73*
A x B	19.76	1	19.76	1.62
Error	561.83	46	12.21	
Total	23034.00	49		

*p<0.01

TABLE 3: DESCRIPTIVE STATISTICS OF COGNITIVE FUNCTION (BAMES) ACCORDING TO DIABETES STATUS AND LITERACY STATUS

Parameter	Response	*N*	*Mean*	*SD*
Diabetes Status	Diabetic	25	22.88	4.42
	Non diabetic	25	19.04	4.16
Literacy Status	Literate	30	22.97	4.57
	Illiterate	20	17.95	2.89

Table 2 shows that there were significant main effect of diabetes (F =12.62, df =1/49, $p < 0.01$) and literacy (F = 24.73, df = 1/49, $p < 0.01$) on cognitive function. The results indicate that cognitive function of diabetic (22.88) older people is significantly different from the cognitive function of non diabetic (19.04) older people. Our first hypothesis states that cognitive function of non diabetic older adult would be better than diabetic older adult but the findings rejected our first hypothesis. This finding contradicts with (Zilliox *et al.*, 2016). It is found here that despite being a risk factor of cognitive deficit, diabetes did not affect older peoples' cognition. The possible causes might be the awareness and control of diabetes. It is evident that to control diabetes people need to maintain a routine physical activity and dietary. Physical activity (Kramer and Erickson

2006) and dietary (Witte and Fobker 2009) improve cognitive ability despite having diabetes. Older adult with diabetes can maintain their cognitive functions by monitoring of blood glucose; eating healthy meals; engaging in physical activity; taking medications as directed; recognizing and managing hypoglycemia; performing proper hygiene, including foot and dental care; attending medical appointments; and understanding sick-day management (Ogbera and Adeyemi 2011). It is common that people with well cognitive function are able to control their physical problem which positively affects their health. The findings of the present study have provided a new insight for the diabetes of older patient in Bangladesh.

The results also indicate a significant difference between cognitive function (CF) score of literate (M = 22.97) older people was better than the cognitive function of Illiterate (M = 17.95) older people. Our second hypothesis was H_2: Cognitive function of literate older adult would be better than illiterate older adult which is supported by this result. Older people with education have better CF than those who have no education. So, education positively affects cognitive function of older people in this study. This finding is in the line with Alewijn and Jules (1995). Education improves cognitive function in a variety of ways. Education may increase competency, improve reading, math, and reasoning skills, as well as problem solving abilities of older adults. At the same time, education improves brain function by creating greater number of synapses. Individuals with higher education may enter old age with a greater synaptic density which enriches their cognitive function (Diamond 1988). Educated older people are hypothesized to process tasks more efficiently than non-educated older people (Stern 2002) because they make more efficient use of brain networks.

REFERENCES

ALEWIJN, O., AND JULES, J. C. 1995. Dementia and its subtypes in the general population and examine the relation of the disease to education. *Bangladesh Medical Journal,* **310:** 970.

BADDELEY, A. D. 2002. *Fractionating the central executive* In Stress, D. T. and Knight, R. T. (Eds.), *Principles of Frontal Lobe Function* (pp. 246). Oxford: Oxford University Press.

BAKER, D. W. 2006. The meaning and the measure of health literacy. *Gen Intern Med,* **21**: 878-883.

CDC. 2011. *Cognitive Impairment: The Impact on Health in Iowa*. Atlanta: U.S. Department of Health and Human Services pp.54-66.

CHATTERJEE, S., PETERS, S. A. E., WOODWARD, M., ARANGO, S. M., BATTY, G. D., BECKETT, N., BEISER, A., BORENSTEIN, A. R., CRANE, P. K., HAAN, M., HASSING, L. B., HAYDEN, K. M., KIYOHARA, Y., LARSON, E. B., LI, C.-Y., NINOMIYA, T., OHARA, T., PETERS, R., RUSS, T. C., SESHADRI, S., STRAND, B. H., WALKER, R., XU, W., AND HUXLEY, R. R. 2016. Type 2 Diabetes as a Risk Factor for Dementia in Women Compared With Men: A Pooled Analysis of 2.3 Million People Comprising More Than 100,000 Cases of Dementia. *Diabetes Care*, **39**(2): 300-307.

DESK, C. 2015. 8.4m diabetic in Bangladesh. *The Daily Star*. Retrieved from http://www.thedailystar.net/city/84m-diabetic-bangladesh-144484.

DIAMOND, M. C. 1988. Enriching Heredity: The Impact of the Environment on the Anatomy of the Brain. New York: Free Press.

EDWARD, W., KRISTINE, Y., JANE, A., CAULEY, P. H., DEBORAH, B., AND ROLKA, M. S. T. 2000. Terri Diabetes Associated With Cognitive Impairment and Cognitive Decline Among Older Women. *Arch Intern Med*, **160**(2): 174-180.

GLYMOUR, M. M., TZOURIO, C., AND DUFOUIL, C. 2012. Is Cognitive Aging Predicted by One's Own or One's Parents' Educational Level? Results From the Three-City Study. *American Journal of Epidemiology*, **175**(8): 750–759.

GODBOLE, S., GODBOLE, G., AND VAIDYA, S. 2016. Influence of education on cognitive function in the elderly population of Pune city, Maharashtra, India. *International Journal of Research in Medical Sciences*, **4**(9): 4119-4122.

HAZARI, M. A. H., REDDY, B. R., UZMAA, N., AND KUMARA, B. S. 2015. Cognitive impairment in type 2 diabetes mellitus. *International Journal of Diabetes Mellitus*, **3**(1): 19-24.

HENDRIE, H. C., ALBERT, M. S., BUTTERS, M. D., GAO, S., KNOPMAN, D. S., LAUNER, L. J., AND YAFFE, K. 2006. The NIH cognitive and emotional health project: report of the critical evaluation study committee. *Alzheimer's & Dementia: Journal of the Alzheimer's Association*, **2**(1): 12-32.

KABIR, Z. N., AND HERLITZ, A. 2000. The Bangla adaptation of mini-Mental State Examination (BAMSE): An Instrument to Assess Cognitive

Function in Illiterate and Literate individuals. *International Journal of Geriatric Psychiatry* **15**: 441-450.

KRAMER, A. F., AND ERICKSON, K. I. 2006. Exercise, cognition, and the aging brain. *J Appl Physiol*, **101**(4): 12-37.

LAMOTTEA, G., MORELLOC, R., LEBASNIERD, A., AGOSTINID, D., BOUVARDD, G., SAYETTEA, V. D. L., AND DEFERA, G. L. 2016. Influence of education on cognitive performance and dopamine transporter binding in dementia with Lewy bodies. *Clinical Neurology and Neurosurgery*, **146**: 138–143.

LENEHAN, M. E., SUMMERS, M. J., SAUNDERS, N. L., SUMMERS, J. J., AND VICKERS, J. C. 2015. Relationship between education and age-related cognitive decline: a review of recent research. *Psychogeriatrics*, **15**(2): 154 –162.

MCCRIMMON, D. R. J., RYAN, C. M., AND FRIER, B. M. 2012. Diabetes and cognitive dysfunction. *The Lancet*, **379**(9833): 2291–2299.

MORGAN, L., AND KUNKEL, S. 1998. *Aging: The Social Context*. California: Pine Forge Press. 145-182 pp.

OGBERA, A., AND ADEYEMI, D. A. 2011. Emotional distress is associated with poor self-care in type 2 diabetes mellitus. *J Diabetes*, **3**: 348–352.

RAHMAN, M. S., AKTER, S., ABE, S. K., ISLAM, M. R., MONDAL, M. N. I., RAHMAN, J. A. M. S., AND RAHMAN, M. M. 2015. Awareness, Treatment, and Control of Diabetes in Bangladesh: A Nationwide Population-Based Study. *PLOS ONE*, **10**(2): 1-14.

SHARRETT, A. R. 2012. Is Cognitive Aging Predicted by Educational Level? *American Journal of Epidemiology*, 1-2.

STERN, Y. J. 2002. What is cognitive reserve? Theory and research application of the reserve concept. *Int Neuropsychol Soc*, **8**(3):448-60.

TRIPP, S. L., AND COLLEGE, G. 2005. *The Aging Brain: Theories of our Inevitable Cognitive Decline*, 1-14 pp.

WARE, J. 1998. *WHO (Five) Well-Being Index (1998 version)*. Frederiksborg General Hospital: Psychiatric Research Unit WHO Collaborating Centre in Mental Health, pp. 34-55.

WORLD HEALTH ORGANIZATION. 1984. Glossary of terms used in the "Health for All" Series N. 1-8. World Health Organization, Geneva.

WILSON, R. S., AND BARNES, L. L. 2002. Depressive symptoms, cognitive decline, and risk of AD in older persons. *Neurology*, **59**: 364-370.

WITTE, A. V., AND FOBKER, M. 2009. Caloric restriction improves memory in elderly humans. *Proc Nat Acad Sci*, **106**(4): 1255–1260.

ZAHODNE, L. B., GLYMOUR, M. M., SPARKS, C., BONTEMPO, D., DIXON, R. A., MACDONALD, S. W. S., AND MANLY, J. J. 2011. Education Does Not Slow Cognitive Decline with Aging: 12-Year Evidence from the Victoria Longitudinal Study. *Journal of the International Neuropsychological Society*, **17**: 1-8.

ZILLIOX, L. A., CHADRASEKARAN, K., KWAN, J. Y., AND RUSSELL, J. W. 2016. Diabetes and Cognitive Impairment. *Current Diabetes Reports*, **16**: 87.

Manuscript received on 31.08.2016; Accepted on 16.09.2021
The Chittagong University Journal of Biological Sciences, Vol. 10 (1 & 2). Page No.191-199.