J Young Pharm, 2022; 14(3) : 305-309
A multifaceted peer reviewed journal in the field of Pharmacy
www.jyoungpharm.org | www.phcog.net

Original Article

A Prospective Study to Estimate the Prevalence of Cognitive Impairment and its Risk Factors in Patients having Diabetes Mellitus or Hypertension or a Combination of Both

Ashish Karn[1,*], Nair Jitin Raghunathan[1], Nathani Anamika[1], Naik Manmayee Manishbhai[1], Hemraj Singh Rajput[1], Vivek Vaswani[2]
[1]Department of Pharmacy, Sumandeep Vidyapeeth (Deemed to be University), Piparia, Waghodia, Vadodara, Gujarat, INDIA.
[2]SBKS Medical Institute and Research Centre Dhiraj Hospital, Sumandeep Vidyapeeth (Deemed to be University), Piparia, Waghodia, Vadodara, Gujarat, INDIA.

ABSTRACT

Background: Different studies across the world have shown there is an association between non-communicable diseases (NCDs) and accelerated decline of cognitive function leading to mild cognitive impairment. The aim of the study was to estimate and study the prevalence of Cognitive impairment and its risk factor in patients having only DM or only HTN or a combination of both. **Methods:** An observational, prospective Cross-sectional Study was conducted in tertiary care hospital which includes patients' ≥45 years of age clinically diagnosed with hypertension, diabetes mellitus or both. A proforma, Mini Mental Status Examination (MMSE) and Morisky Medication Adherence Scale (MMAS) was used to assess risk factors of cognitive impairment. **Results:** Near around one-fourth (24%) of subjects had cognitive impairment based on MMSE score. MMSE score was lowest amongst patient with hypertension(HTN) (21.61±5.21), followed by both (23.91±4.81) and then diabetes mellitus(DM) (24.93±2.86). Subjects having HTN and was cognitive impaired (50%) had low medication adherence followed by DM (22.72%) and both (22.72%). Cognitive Impairment was significantly higher amongst subject who was less physically active, those who were living alone and socio-economic status also had influence on cognitive impairment based on chi-square test. **Conclusion:** Elder population with non-communicable diseases have higher prevalence of cognitive impairment. Healthcare professionals should provide a proper counselling to their family members especially related to medication adherence and preventive measure to minimize the risk of developing dementia.

Keywords: Mild Cognitive impairment, Hypertension, Diabetes mellitus, Non-communicable diseases, Medication adherence, Risk factor.

Correspondence

Dr. Ashish Karn,

Pharm D Intern, Department of Pharmacy, Sumandeep Vidyapeeth (Deemed to be University), Piparia, Vadodara-391 760, Gujarat, INDIA.

Email id: ashishkarn62@gmail.com

DOI: 10.5530/jyp.2022.14.60

INTRODUCTION

Older adults are at higher risk for cognitive impairment.[1] The prevalence of cognitive impairment ranges from 14% to 21% in population-based studies of older adults.[2] India's elderly population has already crossed 100-million mark during 2011. It is estimated that this number will increase by more than 300 million by 2050.[3]

Various factors have been linked with cognitive impairment and dementia, which includes intelligence status, socioeconomic conditions, low education level and employment status[4] fewer studies also have found tobacco and alcohol use as the predictors for the cognitive decline.[5] Different studies across the world have shown there is an association between Non-communicable diseases (NCDs), especially cardiovascular diseases and diabetes mellitus (DM), and accelerated decline of cognitive function leading to mild cognitive impairment. But still the causality between NCDs and cognitive impairment is unknown.[6-9]

Among vascular risk factor chronic arterial hypertension is a major contributor to cognitive impairment. The brain is one of the main targeted organs affected by hypertension. Structural and functional alterations of cerebral vessels which occurs to great extent by HTN contributes to Cognitive Impairment as there is increased chances of developing cerebrovascular strokes (ischemic or hemorrhagic). Various factor like alteration in vascular structure, atherosclerosis, microvascular rarefaction, vascular remodeling and stiffening can cause cognitive changes.[10]

Cognitive dysfunction in case of Diabetes mellitus is linked with Brain insulin and insulin like growth factor resistance which results in the abnormality and structural changes in the brain cells causing problems in signaling pathways that regulate neuronal survival, gene expression, energy production, and plasticity. At the cellular level it causes main structural and physiochemical changes like expression of AβPP-Aβ and accumulation of AβPP-Aβ, activity of Tau protein is disrupted by enzyme changes of kinases by phosphorylation, damage of proteins, RNA, DNA and lipids due to generation of reactive oxygen and reactive nitrogen species and activation of pro inflammatory and pro death cascades. This results in down regulation of target genes required for cholinergic homeostasis, and it compromises the systems.[11-12]

MATERIALS AND METHODS

An observational, prospective cross-sectional study was conducted at tertiary care hospital in Vadodara, Gujarat, India. The approval was taken from the Sumandeep Vidyapeeth Institutional Ethics Committee (SVIEC) with approval number: SVIEC/ON/PHAR/BNPG20/21004.

All the clinical data of the patients, over 45 years of age clinically diagnosed with hypertension, diabetes mellitus or both in out-patient department (OPD) and in-patient department (IPD) of General Medicine was taken. The study was conducted for 6 months. Information was collected from the patient and patient's medical record file. A proforma was used, to assess risk factors of cognitive impairment which

includes socio-demographic data such as age, gender, marital status, education, type of family. Environmental/ Occupational data such as monthly income and area of residence. Behavioural characteristics data like physical activity, alcohol and tobacco usage and the presence of co-morbidities was assessed. Mini Mental Status Examination (MMSE) score and Morisky Medication Adherence Scale(MMAS) was used to assess cognitive function and medication adherence respectively.

During the study, all the numeric (quantitative data) was presented in mean ± standard deviation and parametric tests like *t*-test (for comparing the mean differences between two groups), ANOVA test (comparing the mean differences between >2 groups).

Qualitative data was presented in percentage and non-parametric tests like chi-square test was used. *p*-value<0.05 will be taken as significant.

Inclusion Criteria

All the clinical data of the patients, over 45 years of age clinically diagnosed with hypertension, diabetes mellitus or both in out-patient department (OPD) and in-patient department (IPD) of General Medicine was taken and Type 1 Diabetes Mellitus and Autoimmune Diabetes Mellitus patients were also included.

Exclusion Criteria

Patients recently diagnosed with hypertension, diabetes mellitus or both less than 1yrs or those who cannot comply with study protocol or patients having critical illness/admitted to critical care unit or patients with coexisting psychiatric illness or patients with chronic alcoholism and comorbid complication due to daily consumption of alcohol for more than > 5 years were excluded.

RESULTS

A total of 100 patients were enrolled in the study according to the proposed inclusion and exclusion criteria. The data was collected by the means of proforma and collection of information based on patient medical record sheet and patient interview. In our study we found 24% subjects were cognitive impaired. MMSE and MMAS were used to assess cognition function and assessment of medication adherence respectively. Sociodemographic influence on Cognitive impairment are summarized in Table 1.1. The maximum number of subjects in whom cognitive impairment was present were found in the age range of 56-65 years (50%, *n* =12), then in the age of 45 to 55 years (25%, *n*=6), and in the age of > 66 years (25%, *n*=6). Male patients were more (65%, *n* =65) as compared to female patients (35%, N=35) and also cognitive impairment were more amongst male (62.5%, *n*=15) compared to female (37.5%, *n*=9). Cognitive impairment were present amongst subject staying in rural locality (54.17%, *n*=13) was more as compare to urban locality (45.83%, *n*=11). As per our study based on duration of disease cognitive impairment was highest in those with who had 5-10 years (54.17%, *n*=13) duration of diseases followed by 1-5 years (41.67%, *n*=10), and >10yrs (4.17%, *n*=1).Cognitive Impairment was more prevalent amongst patient who had no primary education (33.33%, *n*=8) followed by primary schooling (29.17%, *n*=7) and secondary schooling (29.17%, *n*=7) then higher schooling (4.17%, *n*=1) and graduate above (4.17%, *n*=1).Cognitive impairment were present amongst subject staying in nuclear family (58.33%, *n*=14) was more as compared to joint family (41.67%, *n*=10) and Cognitive Impairment was more prevalent amongst patient who had not been physically active (87.5%, *n*=21) compared to those who was more physically active (12.5%, *n*=3). Cognitive Impairment amongst patient who was staying alone (45.83%, *n*=11) and not staying alone (54.17%, *n*=13). Cognitive Impairment was present amongst patient who was married (95.83%, *n*=23), divorced (4.17%, *n*=1) and widow/widower (54.17%, *n*=0). Cognitive Impairment

Table 1.1: Influence of Socio-demographic Characteristic on Cognitive Function.

	Present	Present %	Absent	Absent %	Total	Total %	Chi square p-value
	24	24	76	76	100	100	
Age							
45-55 yrs	6	25	25	32.8	31	31	
56-65 yrs	12	50	40	52.6	52	52	1.579 (0.4538)
>66 yrs	6	25	11	14.4	17	17	
Sex							
MALE	15	62.5	50	65.79	65	65	0.0868 (0.7683)
FEMALE	9	37.5	26	34.21	35	35	
Duration of Diseases							
1-5 yrs	10	41.67	22	28.95	32	32	
5-10 yrs	13	54.17	53	69.74	66	66	2.3334 (0.3113)
>10 yrs	1	4.17	1	1.32	2	2	
Education							
<Primary schooling	8	33.33	17	22.37	25	25	
Primary schooling	7	29.17	33	43.42	40	40	
Secondary	7	29.17	17	22.37	24	24	2.8783 (0.5783)
Higher schooling	1	4.17	7	9.21	8	8	
Graduate above	1	4.17	2	2.63	3	3	
Socio-economic status							
APL (>1875Rs)	14	58.33	72	94.74	86	86	20.0764 (0.00001)
BPL(<1875Rs)	10	41.67	4	5.26	14	14	
Locality							
Urban	11	45.83	41	53.95	52	52	0.4811 (0.4879)
Rural	13	54.17	35	46.05	48	48	
Living Alone							
Yes	11	45.83	3	3.95	14	14	26.5788 (0.00001)
No	13	54.17	73	96.05	86	86	
Marital Status							
Married	22	91.6	72	94.74	94	94	0.7617 (0.6832)
Divorced	1	4.16	1	1.32	2	2	
Widow/ widower	1	4.16	3	3.95	4	4	
Physical Activity							
Yes	3	12.5	34	44.74	37	37	8.1318 (0.0043)
No	21	87.5	42	55.26	63	63	
Type of family							
Nuclear	14	58.33	28	36.84	42	42	3.4584 (0.0529)
Joint	10	41.67	48	63.16	58	58	
Diseases							
HTN	13	54.17	10	13.16	23	23	
DM	5	20.83	36	47.37	41	41	17.5306 (0.0001)
BOTH	6	25	30	39.47	36	36	

Table 1.2: Mini-Mental State Examination Score (MMSE).

	HYPERTENSION (n=23)		DIABETES (n=41)		BOTH (n=36)		TOTAL (n=100)		ANOVA	Post Hoc Analysis
	MEAN	S.D	MEAN	SD	MEAN	S.D	MEAN	S.D	*P*-Value (F)	
TOTAL MMSE	21.61	5.21	24.93	2.86	23.97	4.81	23.82	4.38	0.0125 (4.5864)	1 vs 2, p=0.0091. 1 vs 3, p=0.0949. 2 vs 3, p=0.5885
DOMAIN										
Orientation to time	3.43	1.16	4.00	0.81	3.75	1.44	3.78	1.16	0.1651 (1.8349)	1 vs 2, p=0.1424. 1 vs 3, p=0.5508. 2 vs 3, p=0.6078
Orientation to place	3.78	1.09	4.29	0.90	4.31	0.89	4.18	0.96	0.0742 (2.6727)	1 vs 2, p=0.0974. 1 vs 3, p=0.0995. 2 vs 3, p=0.9614
Registration	2.87	0.63	2.98	0.16	2.97	0.17	2.95	0.33	0.3667 (1.0137)	1 vs 2, p=0.3993. 1 vs 3, p=0.4169. 2 vs 3, p=NaN.
Attention and Calculation	1.91	1.62	2.88	1.31	2.81	1.31	2.63	1.43	0.0209 (4.0279)	1 vs 2, p=0.0238. 1 vs 3, p=0.0457. 2 vs 3, p=0.9731.
Recall	2.70	0.70	2.66	0.57	2.78	0.54	2.71	0.59	0.6711 (0.4005)	1 vs 2, p=0.9636. 1 vs 3, p=0.8684. 2 vs 3, p=0.6494
Naming	1.91	0.42	1.98	0.16	1.94	0.33	1.96	0.28	0.7303 (0.3154)	1 vs 2, p=0.7148. 1 vs 3, p=0.9229. 2 vs 3, p=0.8962.
Repetition	0.87	0.34	0.98	0.16	0.97	0.17	0.95	0.22	0.0956 (2.3952)	1 vs 2, p=0.1185. 1 vs 3, p=0.1308. 2 vs 3, p=NaN
Read and Follow Command	3.04	1.40	3.63	0.49	3.22	1.20	3.35	1.05	0.0235 (3.8981)	1 vs 2, p=0.0307. 1 vs 3, p=0.7243. 2 vs 3, p=0.1080
Sentence	0.87	0.34	0.95	0.22	0.92	0.28	0.92	0.27	0.4390 (0.8302)	1 vs 2, p=0.4091. 1 vs 3, p=0.7671. 2 vs 3, p=0.7931.
Copying	0.22	0.42	0.51	0.51	0.25	0.44	0.35	0.48	0.0144 (4.4318)	1 vs 2, p=0.0359. 1 vs 3, p=0.9428. 2 vs 3, p=0.0386.

Table 1.3: Morisky Medication Adherence Scale(MMAS)

	HTN		DM		BOTH		
	Cognitive Impairment		Cognitive Impairment		Cognitive Impairment		
Adherence	Present (Present %)	Absent (Absent %)	Present (Present %)	Absent (Absent %)	Present (Present %)	Absent (Absent %)	*p*-VALUE (*t*-test)
Low	11(50%)	0	5(22.72%)	1(4.54%)	5(22.72%)	0	0.0303
Moderate	2(3.33%)	6(10%)	0	26(43.3%)	1(1.6%)	25(41.6%)	0.0511
Good	0	4(22.2%)	0	9(50%)	0	5(27.7%)	0.0171

was present amongst patient who were APL (58.33%, *n*=14), and BPL (41.67%, *n*=10). Cognitive Impairment was more prevalent amongst patient who had HTN (54.17%, *n*=13) followed by patient who had HTN and DM both (25%, *n*=6) and then followed by DM (20.83%, *n*=5).

The overall mean of MMSE was found to be 23.82 ±4.37. A one-way ANOVA was done to find the difference amongst subject having different NCDs shown in Table 1.2. The scores amongst subjects with different NCDs were HTN (21.61±5.21), DM (24.93±2.86), and BOTH (23.91±4.81). Compared to DM, HTN and BOTH, MMSE score was lowest among HTN in all the domains including orientation to time (3.43±1.16), orientation to place (3.78±1.08), registration (2.86±0.62), Attention and Calculation (1.91±1.62), Naming (1.91±0.41), Repetition (0.86±0.34), Read and Follow Command (3.04±1.39), Sentence (0.86±0.34), Copying (0.22±0.42) except Recall (2.69±0.70). Overall there was significant difference amongst HTN, DM and both as p value was 0.0125. Post-hoc analysis was performed, which shows that MMSE was significantly lower amongst people with HTN when compared to DM (Diff=3.3200, 95%CI=0.6982 to 5.9418, p=0.0091) and there was no significant difference between BOTH (Diff=2.2100, 95%CI=-0.4765 to 4.8965, p=0.1283).

MMAS scale was used for medication adherence assessment. Medication adherence was lowest amongst subject whose MMSE score was < 23 i.e., cut-off for dementia. There is clinically significant difference between medication adherence and cognitive impairment amongst low adherence group (p value = 0.030), moderate adherence group (p value = 0.051), good adherence group (p value = 0.0171). Amongst Low adherence group, medication adherence was lowest in subject having HTN and had cognitive impairment (50%) followed by DM (22.72%) and both (22.72%) mentioned in Table 1.3.

DISCUSSION

Cognitive impairment is critical and most prevalent complication in patients having diabetes mellitus and hypertension especially in the elderly age group due to its long-term implications. To maintain their quality of life, elders with cognitive impairment would require additional attention and time from their families. The current study was conducted amongst the older adults > 45years at the out- patient and in-patient department of tertiary care hospital in India. The average age of the participants was in between 56- 65 years, and the majority of subjects were male in which cognitive impairment was present, as in our study male population was higher compare to female population.

In our study about 24% of participants had cognitive impairment according to the MMSE scores i.e., <23, which is considered to be cut-off for dementia. The prevalence of dementia is in between 1.7 and 40% amongst people having diabetes mellitus and hypertension, according to the different literatuare.[3,13-16] The current study's findings are also consistent with this prevalence range. In this study, cognitive impairment was found to be significantly higher in people of age range 55-65years with lower primary education levels, those who were staying alone, were physically inactive and with less income per capita who had been diagnosed with hypertension compared to those who had been diagnosed with diabetes mellitus or both diseases and had the disease for a duration of more than 5years. According to the available evidence, cognitive impairment varies with disease duration and is higher amongst patients having hypertension compared to patient with only diabetes mellitus or both. Hypertension is a known risk factor for cognitive decline, especially when it begins amongst middle age range, and that it can be prevented if diagnosed early and taken proper medications.

Hypertension is linked to several types silent brain infarcts, a smaller total brain volume, or a lower pathologic threshold at which cognitive decline manifest, more beta-amyloid (A) deposition in the brain, and altered cerebral spinal fluid profiles of various biomarkers linked with cognitive decline.[17-18]

Although the specific pathogenesis is yet unknown, available data suggests that diabetes mellitus (both Type1 and Type 2) are linked with cognitive decline.[18] Diabetes mellitus is linked with Brain insulin and insulin like growth factor resistance which results in the abnormality and structural changes in the brain cells causing problems in signaling pathways that regulate neuronal survival, gene expression, energy production, and plasticity. At the cellular level it causes main structural and physiochemical changes like expression of AβPP-Aβ and accumulation of AβPP-Aβ, activity of Tau protein is disrupted by enzyme changes of kinases by phosphorylation, damage of proteins, RNA, DNA and lipids due to generation of reactive species and activation of pro inflammatory and pro death cascades. This results in down regulation of target genes required for cholinergic homeostasis, and it compromises the systems.[11]

Except for the Recall domain, people with hypertension exhibited lower mean scores in all of the MMSE domains when compared to the other two groups. Based on these findings, patients with hypertension should be advised to make lifestyle changes in order to better regulate their blood pressure. Age above 55 years, lower education status, high per capita income, extended duration of illnesses, and hypertension appeared as risk factors linked with cognitive impairment according to the Chi-square p-value method. Age, widowhood, and illiteracy have all been linked with increased incidence of cognitive decline in research. Other studies have found no link between cognitive decline and factors such as education, gender, locality, or income.

However, other research has found a link between higher education and income and cognitive decline. Similar to a prior study, illiteracy was found as a major factor associated with cognitive impairment/dementia in our investigation. As a result, illiteracy can be one of the factors results in cognitive decline.

We also studied medication adherence of the subjects by using Morisky Medication Adherence Scale (MMAS). We found that subject having HTN and those who had cognitive impairment had the lowest adherence compare to those having DM and BOTH. So, we counselled the family member/care giver regarding the importance of medication adherence that determines the therapeutic outcomes and efficacy of the drugs, which in turn helps in controlling disease progression and overall long-term health quality of the patients.

Due to current covid-19 pandemic situation and limited period of time, the study shows number of limitations that may restrain the study. Based on current situation our sample size was small and also our study was limited to tertiary care hospital in the western region of India and thus the findings cannot be generalised. Our study design is cross-sectional so temporal assessment of causation cannot be established. Long term follow-up was not recorded as this was a six months study and only immediate outcome was recorded. Risk-factors like the stress, anxiety was not included.

CONCLUSION

In our study we found around one-fourth (24%) of subject had cognitive impairment based on MMSE score. Cognitive impairment was more prevalent and statistically significant among subject having HTN followed by both and then DM. We studied about various risk factors of cognitive decline which includes: socio-demographic data such as environmental/ occupational and behavioural characteristics data. We found that Cognitive decline was significantly higher amongst HTN followed by those who had both HTN and DM and then DM. Cognitive Impairment was significantly higher amongst subject who was less physically active, those who were living alone and socio-economic status also had influence on cognitive impairment. Prevalence of cognitive impairment was not significant based on age and gender. Also socio-demographic variables like duration of diseases, education, locality, types of family, marital status had no significant influence on cognitive impairment. We also studied medication adherence of the subject by using Morisky Medication Adherence Scale (MMAS). We found that subject having HTN and those who had cognitive impairment had the lowest adherence compare to DM and BOTH. So we counsel the family member/care giver along with the subject regarding the importance of medication adherence. Hence, people should be screened at primary level for their cognitive function and appropriate referral of patient should to done to tertiary Centre for earlier diagnosis and to prevent further complications.

CONFLICT OF INTEREST

The authors declare no conflict if interest.

ACKNOWLEDGEMENT

We would like to express our respect towards our co-guide, Dr. Vikas Chandrakar Pharm. D., Associate Professor, Department of Pharmacy, Sumandeep Vidyapeeth who guided us throughout our dissertation work. Whenever our guide was unavailable we have always received valuable guidance and support from sir which has allowed us to improve our work.

ABBREVIATIONS

MCI- Mild Cognitive Impairment, **DM**- diabetes mellitus, **HTN**- hypertension, **MMSE**- Mini-Mental State Examination, **MMAS**- Morisky Medication Adherence Scale.

REFERENCES

1. Patterson C. Screening for cognitive impairment in the elderly. In: Goldbloom R, editor. The Canadian Task Force on the Periodic Health Examination. Canadian guide to clinical preventive health care. Ottawa: Canada Communications Group; 1994. p. 902-11.
2. Ferucci L, Guralnik JM, Salive ME, *et al*. Cognitive impairment and risk of stroke in the older population. J Am Geriatr Soc. 1996;444:237-42.
3. Government of India. Census of India. Office of the registrar general and census commissioner, ministry of home affairs.
4. Poddar K, Kant S, Singh A, Singh TB. An epidemiological study of dementia among the habitants of eastern Uttar Pradesh, India. Ann Indian Acad Neurol. 2011;14(3):164-8. doi: 10.4103/0972-2327.85874, PMID 22028526.
5. Krishnamoorthy Y, Sarveswaran G, Sakthivel M, Rehman T, Majella M, Kumar S. Screening for mild cognitive impairment among noncommunicable disease patients attending a rural primary health center in Puducherry, South India. J Nat Sc Biol Med. 2019;10(1):77-81. doi: 10.4103/jnsbm.JNSBM_90_18.
6. Khullar S, Kaur G, Dhillon H, Sharma R, Mehta K, Singh M, *et al*. The prevalence and predictors of cognitive impairment in type 2 diabetic population of Punjab, India. J Soc Health Diabetes. 2017;05(1):047-53. doi: 10.4103/2321-0656.193996.
7. Lindsay AZ, Krish C, Justin YK, James WR. Diabetes and cognitive impairment. Curr Diab Rep. 2016;16:87.
8. Kataria L, Pandya H, Shah S, Shah H, Gerg R. Prevalence and pattern of cognitive dysfunction in type 2 diabetes mellitus. Int J Appl Sci. 2013;2:246-52.
9. Salive ME, Satterfield S, Ostfeld AM, Wallace RB, Havlik RJ. Disability and cognitive impairment are risk factors for pneumonia-related mortality in older adults. Public Health Rep. 1993;108(3):314-22. PMID 8497569.
10. Iadecola C, Yaffe K, Biller J, Bratzke LC, Faraci FM, Gorelick PB, *et al*. Impact of hypertension on cognitive function: A scientific statement from the American Heart Association. Hypertension. 2016 Dec;68(6):e67-94. doi: 10.1161/HYP.0000000000000053, PMID 27977393.
11. De la Monte SM. S. Brain insulin resistance and deficiency as therapeutic targets in Alzheimer's disease. Curr Alzheimer Res. 2012;9(1):35-66. doi: 10.2174/156720512799015037, PMID 22329651.
12. Arnold SE, Arvanitakis Z, Macauley-Rambach SL, Koenig AM, Wang HY, Ahima RS, *et al*. Brain insulin resistance in type 2 diabetes and Alzheimer disease: Concepts and conundrums. Nat Rev Neurol. 2018 Mar;14(3):168-81. doi: 10.1038/nrneurol.2017.185, PMID 29377010.
13. Das SK, Pal S, Ghosal MK. Dementia: Indian scenario. Neurol India. 2012;60(6):618-24. doi: 10.4103/0028-3886.105197, PMID 23287325.
14. Shaji S, Promodu K, Abraham T, Roy KJ, Verghese A. An epidemiological study of dementia in a rural community in Kerala, India. Br J Psychiatry. 1996;168(6):745-9. doi: 10.1192/bjp.168.6.745, PMID 8773818.
15. Sharma D, Mazta S, Parashar A. Prevalence of cognitive impairment and related factors among elderly: A population-based study. J Dr NTR Univ Health Sci. 2013;2(3):171. doi: 10.4103/2277-8632.117182.
16. Sosa AL, Albanese E, Stephan BCM, Dewey M, Acosta D, Ferri CP, *et al*. Prevalence, distribution, and impact of mild cognitive impairmentin Latin America, China, and India: A 10/66 population-based study. PLOS Med. 2012;9(2):e1001170. doi: 10.1371/journal.pmed.1001170, PMID 22346736.
17. Hughes TM, Sink KM. Hypertension and its role in cognitive function: Current evidence and challenges for the future. Am J Hypertens. 2016;29(2):149-57. doi: 10.1093/ajh/hpv180, PMID 26563965.
18. McDonald C, Pearce MS, Kerr SRJ, Newton JL. Blood pressure variability and cognitive decline in older people: A 5-year longitudinal study. J Hypertens. 2017;35(1):140-7. doi: 10.1097/HJH.0000000000001120, PMID 27648719.

Article History: Received: 14-02-2022; Revised: 25-04-2022; Accepted: 17-05-2022.
Cite this article: Karn A, Raghunathan NJ, Anamika N, Manishbhai NM, Rajput HS, Vaswani V. A Prospective Study to Estimate the Prevalence of Cognitive Impairment and its Risk Factors in Patients having Diabetes Mellitus or Hypertension or a Combination of Both. J Young Pharm. 2022;14(2):305-9.