Cognitive Status and its Association with Individual Components of Metabolic Syndrome in Community Dwelling Older Adults of Delhi: A Pilot Study

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ABSTRACT: Prevalence of components of metabolic syndrome among elderly has increased which is associated with declined cognitive functions and other age associated challenges. Impaired cognition and reduced cognitive abilities can affect social, functional, and occupational activities. The aim and objective of the present study is to determine the association of both in community-dwelling people. A cross-sectional study was carried out on community dwelling individuals in Delhi. Data on socio-demographic, anthropometric, cardio-vascular, bio chemical and cognitive health status variables was collected in urban Delhi (North India). Cognitive decline was found to be more prevalent among females than males and it is correlated with socio-economic background. Only BMI as a marker of adiposity is associated with decline in cognitive functions in this study. However, risk of abdominal obesity, hypertension and high lipid profiles are high among elderly population with significant differences across gender. Present study showed no association of metabolic syndrome with cognitive functions. Individual component of metabolic syndrome including obesity, high adiposity, hypertension, poor lipid profile has been reported in the community dwelling elderly.

INTRODUCTION

The elderly population is growing all over the world. According to the United Nations, this increase will accelerate in the coming decades, owing primarily to an increase in average life expectancy. The world's elderly population (people over the age of 60) will grow by 56% in the next 15 years, and the "oldest old" (people over the age of 80) will triple by 2050. India is now classified as an "Aging Nation" by the United Nations, with a proportion of people over the age of 60 accounting for more than or equal to 7% of the total population. Ageing reduces an individual's physical, mental, and social abilities in their participation in society for a variety of reasons such as physiological degeneration of tissues and organs, fatigability, economic dependence, and social limitations. Ageing problems are not uniform across the globe; they vary according to country profile, gender, residence, socioeconomic status, health, social security mechanism, and prevalent socio-cultural norms, among other factors. Living longer also means living in a state of declining health and disability for a longer period (Panza *et al.*, 2010; Yadav, 2019). Cognition is a bodily function that is decreased by ageing when there is the impairment of memory,

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judgment, language, and attention. It can occur due to neurodegenerative, vascular, and dysthymia/ dysphoria problems. Impaired cognition and reduced cognitive abilities can affect social, functional, and occupational activities. Cognitive impairment is a common problem in the elderly that is associated with age (Eshkoor *et al.*, 2015).The global prevalence of cognitive impairment ranged from 5.1% to 41%, with a median of 19.0%. (Pais *et al.*, 2020). The presence of abdominal obesity, glucose intolerance, hypertension, and/or dyslipidemia defines metabolic syndrome, a cluster of cardiovascular risk factors. It is a major public health problem around the world, as well as a known risk factor for cognitive dysfunction and dementia (Alfaro *et al.*, 2018). The findings of studies on the cognitive status and its association with Metabolic syndrome are mixed. While cross-sectional studies have generally discovered a link between Metabolic syndrome and poor cognitive function, longitudinal studies have discovered both improvement and decline (Siervo *et al.*, 2014).

The objective of this study is to determine the status of cognitive decline and its association with individual components of metabolic syndrome in community dwelling aged people.

MATERIALS & METHODS

Study design: A cross sectional door to door survey study was carried out on 40 (17 males & 23 females) community dwelling individuals belonging to 50 years & above age group in Delhi. Data on socio-demographic, anthropometric, cardio-vascular, bio chemical and cognitive health status variables was collected in urban part of East-Delhi (North India). The research protocol was approved by ethical committee of the Department of Anthropology, Delhi University. Prior written informed consent was obtained from each participant.

Data collection: Socio demographic details like age, gender, education, monthly family income, marital status, living with spouse or not, family type and occupation were collected through general proforma. Anthropometric data includes height, weight, and waist circumference. Height was taken using anthropometric rod and weight by standard weighing balance. As an adiposity marker Waist circumference was measured horizontally through flexible steel tape wherever minimum in between lowest rib and iliac crest and body mass index (BMI) was calculated by dividing weight in kg by heightin m^2. Cognitive status was assessed through Mini Mental state examination questionnaire. Cardiovascular data includes SBP (Systolic blood pressure) and DBP (Diastolic blood pressure). It was measured through standardized calibrated mercury column sphygmomanometer on right hand after 15 minutes sitting in resting position. Two readings were noted for all the participants at 5 min interval. Average of two readings were taken. Biochemical data includes lipid profiling involving HDL, LDL, Triglycerides, Cholesterol, and glucose were taken by extracting blood from antecubital vein with the help of expert. Blood samples (2 ml) were drawn after 12- hour fast in early morning at 7:00 am to 8:00am through door-to-door survey with prior informing the participants about collection. Samples were centrifuged within 1 hour of collection. Assessment of HDL, LDL, TG, TC, and glucose was done on the same day of collection.

Data analysis: For analyzing the data, standardized questionnaire and cut-offs were used. Asian cut off for BMI categorization was used. WHO (2004). A single cut-off was used for categorizing cognitive status as normal (>24) and abnormal (<24). SBP and DBP were categorized based on JNC VIII (2014) guidelines which recommends target blood pressure level should be less than 140/90mm/Hg. Metabolic syndrome was defined based on NCEP guidelines, Waist circumference categorized as risk if >88cm for women and >102 for men. LDL, <100 as normal and abnormal otherwise. HDL, <40 as low for men and <50 as low for women and high otherwise, TG, e”150 as high and normal otherwise. TC, <200 as normal and high otherwise, and fasting glucose normal if < 110 and high if, e”110. All these bio-chemical variables were categorized based on NCEP guidelines. National Cholesterol education programme (2001).

Statistical analysis: IBM SPSS statistics 26 was used for statistical analysis. Pearson Correlation and spearman correlation for ranked variables were used to find the degree and direction of association between MMSE and other variables. 95% confidence interval with level of significance $p<0.05$*, $p<0.01$** and $p<0.001$*** were used. For comparing means, independent sample t-test was used. For testing the

independence and significant association of variables, chi-square test was used.

RESULTS

TABLE 1

Gender wise t-test distribution of anthropometric, mental health, cardio vascular and biochemical variables

Variables	Males Mean ± SD	Females Mean ± SD	t-test	at 95% CI
Cognitive status				
Cognitive status (MMSE)	28.70±1.76	21.96±5.48	4.87	0.01**
Adiposity				
BMI(Kg/m^2)	24.37 ± 2.93	29.29±4.72	-3.78	0.01**
WC (cm)	94.029±9.74	95.857±12.46	-0.50	0.619
Cardiovascular				
SBP (mm/Hg)	133.94±17.31	146.30±17.32	-2.23	0.032*
DBP (mm/Hg)	79.29±9.80	85.09±10.50	-1.774	0.084
Biochemical				
HDL (mg/dl)	42.52±10.47	53.40±13.29	-2.793	0.008*
LDL (mg/dl)	100.23±33.54	142.24±58.77	-2.641	0.012*
Triglycerides(mg/dl)	68.65±36.76	95.36±65.00	-1.521	0.137
Cholesterol(mg/dl)	164.52±32.53	202.68±56.56	-2.489	0.017*
Glucose(mg/dl)	131.15±52.67	127.60±45.73	0.228	0.821

p-value<0.05*, <0.01** &<0.001***

Source: Authors

Table1 compares the mean and SD scores between the gender for cognitive status, adiposity markers and hypertension. Mean values indicated that majority of males have normal cognitive status (28.70±1.76), > 24 than females (21.96±5.48), <24. Risk of adiposity as per BMI marker is also higher in females with significant differences. Risk of abdominal adiposity is borderline high in females and not reported in males. Mean SBP values indicated that males (133.94±17.31) and females (146.30±17.32) both have hypertension with significant differences. DBP values shown the higher risk in females than males. Results indicated that mean scores of cognitive statuses, BMI and SBP are significantly different across gender and not in case of DBP and waist circumference. Among biochemical variables females have shown higher risk because of high mean values for LDL and total cholesterol on the other hand males have normal values for the same with significant differences ($p< 0.05$). Both groups have normal HDL with significant result ($p< 0.05$). Normal triglyceride levels and increased value of fasting glucose have been reported with no significant findings.

TABLE 2

Cross tab and chi-square distribution of anthropometric, mental health, cardio vascular and biochemical variables

Variables	Categories	Males N (%)	Females N (%)	$\times^2$-test	at 95% CI
Cognitive status					
Cognitive status (MMSE)	Normal	17(42.5%)	9(22.5%)	15.920*	0.01**
	Abnormal	0	14(35%)		
Anthropometric variable					
BMI (kg/m^2)	Normal	5 (12.5%)	2(5%)	2.906	0.088
	Over wt. & obese	12(30%)	21(52.5%)		
WC (cm)	Normal	13(32.5%)	8(20%)	0.589	0.443
	Risk	4(10%)	15(37.5%)		
Cardiovascular variable					
Blood pressure(mm/Hg)	Normal (SBP)	13(32.5%)	9(22.5%)	5.507*	0.019*
	High (SBP)	4(10%)	14(35%)		
	Normal (DBP)	13(32.5%)	15(37.5%)	0.589	0.443
	High (DBP)	4(10%)	8(20%)		
Biochemical Variables					
HDL (mg/dl)	Normal	11(27.5%)	14(35%)	7.47	0.01*
	Low	6(15%)	9(22.5%)		
LDL (mg/dl)	Normal	14(35%)	11(27.5%)	4.97	0.03*

	High	3(7.5%)	12(30%)		
Triglycerides(mg/dl)	Normal	16(40%)	19(47.5%)	1.28	0.26
	High	1(2.5%)	4(10%)		
Cholesterol(mg/dl)	Normal	15(38.5%)	8(20.5%)	10.665	0.001**
	High	2(5.1%)	14(35.9%)		
Glucose(mg/dl)	Normal	8(20.5%)	10(25.6%)	0.161	0.68
	High	8(20.5%)	13(33.3%)		

p-value<0.05*, <0.01** &<0.001***
Source: Authors

Table 2 shows that 35% females have abnormal cognitive status on the other hand 100% males have normal cognitive status. More people are overweight and obese in which 52.5% are females and 30% are males. Risk of abdominal adiposity is also higher in females (37.5%) than males (10%). Majority of people have high SBP than DBP. Females have higher SBP and DBP than males. Differences in cognitive status and SBP are significant in both the groups. On the other hand, adiposity markers and DBP have not showed significant differences. Majority of individuals (62.5%) have normal HDL and LDL levels with significant differences. Triglycerides are also normal in both the groups with higher % in females than males. Females have high cholesterol than males with significant differences. Glucose levels are almost same in both groups but little high (33%) in females than males (20.5%).

TABLE 3

Correlation of cognitive status (MMSE score) with socio socio-demography, adiposity, cardiovascular and bio-chemical variables

Variables	MMSE (r)
Socio demographic variables	
Gender	0.631**
Education	-0.346*
Occupation	-0.131
Monthly family income	-0.075
Marital status	0.132
Living with spouse	0.214
Family type	0.105
Adiposity markers	
BMI (kg/m^2)	-0.381*
WC (cm)	-0.208
Cardiovascular variable	
SBP (mm/Hg)	0.001
DBP (mm/Hg)	0.081
Biochemical variable	
HDL (mg/dl)	-0.197
LDL (mg/dl)	- 0.237
Glucose(mg/dl)	0.015
Cholesterol(mg/dl)	-0.119
Triglycerides(mg/dl)	-0.013

p-value<0.05*, <0.01** &<0.001***
Source: Authors

Table 3 displays the correlation of cognitive status with socio demographic, adiposity, cardio-vascular and biochemical variables. Gender showed moderate positive significant correlation with MMSE categories. Marital status, whether living with spouse and family type showed weak positive correlation with cognitive status. Education found to be moderately negative correlated with significant values. On the other hand, occupation and monthly family income are showing weak negative correlation. In adiposity marker BMI and WC both are showing weak negative correlation with significant value in case of BMI. SBP and DBP are very poorly correlated with MMSE in positive direction. Biochemical variables are also showing poor correlation with cognitive status. Negative correlation in case of HDL, LDL, Cholesterol,

Triglycerides and positive with glucose have been found with no significant results.

DISCUSSION

In the present cross- sectional study of 40 community dwelling people showed that majority of males have normal cognitive status than females. Females have highly abnormal cognitive status than their counterpart. In a longitudinal study of 993 adults from the Rancho Bernardo, Men were more likely than women to have metabolic syndrome. In women, metabolic syndrome was linked to poorer executive function and a decline in long-term memory (McEvoy *et al*., 2012). In the present study cognitive decline is not strongly correlated with cardiovascular factor, diabetes mellitus, HDL, LDL, TG, cholesterol, and abdominal obesity but showed significant correlation with BMI. A cross-sectional study of the relationship between metabolic syndrome and cognitive function in non-demented community-dwelling older adults in Japan showed that the MMSE score was significantly negatively associated with triglycerides in males and significantly negatively associated with abdominal circumference in females. People with metabolic syndrome performed significantly worse on attention tasks than subjects without metabolic syndrome (Buyo *et al.,* 2020). In a longitudinal study of a Chinese cohort of cognitively normal older people 55 years and older in Singapore showed the risks of progression to dementia were more than four times higher among those with Metabolic syndrome or three or more component Cardio-vascular risk factors at baseline, and more than two times higher among those with diabetes mellitus. The Metabolic syndrome, diabetes mellitus, central obesity, dyslipidemia, and the presence of three or more component cardiovascular risk factors were all associated with a 1.5 to 2 times higher risk of developing mild cognitive impairment (Ng *et al.,* 2016). Another study mentioned, among vascular-related factors, metabolic syndrome has been linked to an increased risk of cognitive decline and overall dementia (Panza *et al.,* 2010). In the present study risk of adiposity as per BMI marker is borderline high in females and not reported in males. More people are overweight and obese in which 52.5% are females and 30% are males. More prospective studies in this area are needed to further investigate the link between obesity and cognitive function in the elderly. Cognitive status and SBP are significantly associated with the gender. Some of the socio-demographic factors and BMI are significantly correlated with cognitive status decline. Taiwan's 18-year longitudinal national sample of older adults shows the role oflife-course socioeconomic disadvantage in late-life cognitive decline, which may manifest as an inequitable distribution of socioeconomic resources over the individual's life course (Chiao *et al.*, 2014).

CONCLUSION

Females have poor cognitive status than males. Obesity, high adiposity, hypertension, poor lipid profile have been reported in the community dwelling elderly. Risk of developing metabolic syndrome is higher in females than males. In the present study metabolic syndrome is not associated with decline in cognitive functions only BMI is associated. Gender differences are strongly correlated with cognitive status and other social variables are poorly correlated with cognitive status. Ageing process associated with bio-social factors and develops the risk factors for metabolic syndrome and cardiovascular health problems. Bio-social approach to assess and modify the risk factors in elderly may help to promote healthy ageing with improved cognitive status.

Limitations of the study: Findings of this study are quite informative and relevant to predict the risk factors for cognitive decline in aged people, but these findings need to be well established with large sample size.

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