ORIGINAL ARTICLE

Determinants of cognitive impairment in elderly population residing in Agra, Uttar Pradesh

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ABSTRACT
Background: Cognitive impairment is a major global health issue, particularly affecting the elderly and challenging healthcare systems. **Aims and Objective**: To assess the determinants of cognitive impairment among elderly people of Agra city. **Methods and material**: Present cross sectional study was carried out among 144 participants residing in Agra city using pretested, predesigned semi structured questionnaire with MMSE. **Result**: In this study 54.2% were males and 45.8 % females. 78.5 % were Hindus and 12.5% were Muslims, 56.3% participants were married and 42.4% were either widowed or divorced, 24% particiants had higher education, 42.4% school education, 33.3% illitrate. Pevalence of cognitive impairment in elderly was 61.8% that was significantly associated with female gender and lower socioeconomic status. **Conclusion**: This study elucidated that cognitive impairment in elderly was significantly higher in female gender and lower socioeconomic status participants.

KEYWORDS
Cognitive Impairment; Elderly; Cross Sectional

INTRODUCTION
Cognitive impairment in elderly is challenging health issue particularly in developing countries where healthcare systems is not capable to address this type of problems and it ranges from mild cognitive impairment (MCI) to severe forms like dementia. This condition impacts worldwide, diminishing individuals' quality of life. In India, where elderly population is growing rapidly, Investigating the various contributing factors responsible for cognitive impairment is essential to developing effective interventions and support mechanisms for this vulnerable group. According to World Health Organization (WHO), around 50 million people are currently affected by dementia, with nearly 10 million new cases emerging each year.(1) In India, the aging population is projected to rise significantly, from 104 million in 2011 to 173 million by 2026, creating an anticipated increase in dementia cases.(2,3) Multiple factors contribute to cognitive impairment in older adults, encompassing biological, psychological, and social determinants. Biological factors, including age, genetics, and chronic health conditions, are significant contributors to cognitive decline. Age remains a major risk factor, with cognitive impairment becoming more prevalent as people grow older.(4) By adopting a community-based approach, our aim was to capture the multifactorial nature of the well-being of older adults within their local contexts. we studied the determinants, facilitators of cognition challenges in this demographic segment.

Aim and objectives: To assess the determinants of cognitive impairment in elderly people of Agra city.

MATERIAL & METHODS
It was a community based cross sectional study, conducted in Agra city, under Community Medicine Department of Sarojini Naidu Medical college Agra from July 2022 to June 2024. A list of all wards of Agra with population in each ward was obtained

from the Nagar Nigam, Agra. One ward from each zone out of four zones of Agra city was randomly selected, Study population included people 60 year old or above residing in the selected wards of any four zones of Agra city. As per exclusion criteria debilitating, chronic and seriously ill and bedridden persons were not included in study.

The sample size calculated for the study was 144 using formula $n = Z^2pq/d^2$. For calculation of sample size considering of elderly population percentage among Indian population according to Ministry of statistics and programme implementation National Statistics office report, Elderly in India 2021, documented projections for percentage of elderly population in total population of India 2021 is 10.1 %. Applying this in formula given calculation of sample was done by appropriate statistical formula ($n= Z^2 PQ/d^2$). uWhere absolute error taken 5 %, calculating this found 139.52. Rounding off this sample size, final sample size achieved was 144.(5)

For selection of study participants, visit was made to each ward for understanding the geographical limit and distribution of houses, then center of ward was identified and one of lanes was randomly selected. In selected lane house visit was made following left-hand rule till the required sample of 36 elderly was achieved. If the sample size would not have been reached in any of the wards, then we would have visited the adjacent ward of same zone to obtain our complete sample size.

Before the start of the interview, the participants were explained the procedure and purpose of the study. An easily understandable, written informed consent was taken from participant/guardians in their local language and their confidentiality was maintained. Participant identification details were taken and a unique serial number was given to each participant. Pre-designed, pre- tested, semi structured questionnaire that containing questions regarding sociodemographic profile and MMSE (mini mental state score examination) was used to take face to face interview of participants. Instructions on skip patterns were given in the questionnaire wherever required. Data thus collected was entered on MS Excel analysed using jamovi software 2.4.8

Ethical Clearance: Approval was taken from Institutional Ethical Committee of Sarojini Naidu Medical College, Agra. IEC no. – SNMC/IEC/2024/279

Operational definition: Elderly population in India, Government of India adopted 'National policy on older persons' in January,1999. Policy defines senior citizen or elderly as a person who is of age 60 years or above.(5)

Sufficient physical activity: According to WHO at least 150 to 300 minutes per week of moderate intensity aerobic physical activity or at least 75–150 minutes of vigorous intensity aerobic physical activity per week or an equivalent combination of moderate- and vigorous-intensity activity throughout the week, for substantial health benefits. This can include slow walking, bathing, or other incidental activities that do not result in a substantial increase in heart rate or breathing rate. Recording of response in sufficient and insufficient by verbal confirmation of participant. (6)

MMSE score criteria was used to assess cognitive impairment.

RESULTS

Distribution of study participants categorized by age and gender with a total sample size of 144 participants. Out of 144 participants 54.2% were males and 45% females.The largest proportion of participants within the 65-69 age group making 31.3% of the total sample. This is followed by the 70-74 age group 27.8%, 60-64 yrs 22.2%. However, as age increased beyond 75 years, the percentage of participants decreased notably. individuals aged 75-79 make up 10.4% of the sample, while those aged 80 and above constitute only 8.3%. Hindus 78.5%, Muslims12.5%, while Christians and others 9%. 56.3% study participants were married being 41.7% males and 14.6% females 42.4% study participants were either widowed or divorced. 17.4% males and 6.9% females had higher education, School education was the highest level 29.2% males and 13.2% females had school education which is highest counts, 7.6% males and 25.7% females were illiterate. In terms of occupation status, 15.3% males and 4.9% females were professional workers, 34% males and 8.3% females were skilled workers, 4.9 %males and 32.6% females were unemployed.

DISCUSSION

The analysis presented in Table 1 and 2 offers a detailed examination of cognitive impairment among study participants, stratified by various demographic, socio-economic, and health-related factors. The findings reveal that age alone did not show a statistically significant association with cognitive impairment, other variables such as gender, marital status, educational status, occupation, socio-economic status (SES), being the head of the family, and right-hand grip strength were significantly associated with cognitive impairment. Though after applying multiple regression model only female gender and socioeconomic status were found to be significantly associated with cognitive impairment as in Table 3.

Table 1 Prevalance of cognitive impairment among study participants and their association with socio demographic factors.

Variables	Cognitive Impairment		Total (N =144)	Chi-sqare test
Age Group in years	**Yes**	**No**	**n (%)**	
60-64	20(13.9)	12(8.3)	32(22.2)	χ^2:4.5
65-69	27(18.8)	18(12.5)	45(31.3)	p-value:0.34
70-74	27(18.8)	13(9)	40(27.8)	
75-79	6(6.3)	9(6.3)	15(10.4)	
≥80	9(6.3)	3(2.1)	12(8.3)	
Gender				**χ^2:20.7**
Male	35(24.3)	43(29.9)	78(54.2)	**p-value:<0.001**
Female	54(37.5)	12(8.3)	66(45.8)	
Marital status				
Married	44(30.6)	33(25.7)	81(56.3)	**χ^2:8.85**
Unmarried	0(0)	2(1.4)	2(1.4)	**p-value:0.012**
Widow/Divorced	45(31.3)	16(11.1)	61(42.4)	
Educational status				
Higher education	7(4.9)	28(19.4)	35(24.3)	**χ^2:49.65**
School education	36(25)	25(17.4)	61(42.4)	**p-value:<0.001**
Illiterate	46(31.9)	2(1.4)	48(33.3)	
Occupation				
Professional	6(4.2)	23(16)	29(20.1)	**χ^2: 29.74,**
Skilled worker	39(27.1)	22(15.3)	61(42.4)	**p-<0.0001**
Unemployed	44(30.6)	10(6.9)	54(37.5)	
SES status*				
Lower	72(50)	19(13.2)	91(63.2)	**χ^2 -34.35, p-<0.0001**
Middle	17(11.8)	30(20.8)	47(32.6)	
Upper	0(0)	6(4.2)	6(4.2)	
Head of family				
Self	64(44.3)	48(33.3)	112(77.8)	**χ^2 -4.6**
other	25(17.4)	7(4.9)	32(22.2)	**p-value:0.031**
Type of family				
Nuclear	9	11	20	χ^2:4.10
Joint	40	21	61	p-value:0.25
Three generation	38	20	58	
Single person	2	3	5	
Total	89(61.8)	55(38.2)	144(100)	

Table 2 Association of physical strength, activity level and biological factors with cognitive impairment among study participants

Variables	Cognitive Impairment		Total (N =144)	Chi -square test
	Yes n (%)	**No n (%)**	**n (%)**	
Physical Activity				
Sufficient	13(9)	13(9)	26(18.1)	χ^2:1.87
Insufficient	76(52.8)	42(29.2)	118(81.9)	p-value:0.17
Time spends with friends and neighbours				
Everyday	31(21.5)	14(9.7)	45(31.3)	χ^2:1.43
Not everyday	53(36.8)	37(25.7)	90(62.5)	p-value:0.48
Never	5(3.5)	4(2.8)	9(6.3)	
Hand Grip strength Right hand(use Camri hand dymemometer and criteria)				
Strong	0(0)	0(0)	0(0)	χ^2:8.4
Normal	0(0)	5(3.5)	5(3.5)	p-value:0.004
Weak	89(61.8)	50(34.7)	139(96.5)	

Variables	Cognitive Impairment		Total (N =144)	Chi -square test
	Yes n (%)	No n (%)	n (%)	
Hand Grip strength Left hand				
Strong	0(0)	0(0)	0(0)	χ^2:0.62
Normal	1(0.7)	0(0)	1(0.7)	p-value:0.43
Weak	88(61.1)	55(38.2)	143(99.3)	
BMI(Asian classification)				
Underweight	2(1.4)	1(0.7)	3(2.1)	χ^2:1.93
Normal	13(9)	13(9)	26(18.1)	p-value:0.58
Overweight	25(17.4)	13(9)	38(26.4)	
Obese	49(34)	28(19.4)	77(53.5)	
Total	89(61.8)	55(38.2)	144(100)	

Table 3 Multivariate analysis of cognitive impairment and determinants of significance

Variables	Category	Odds ratio	95%conf.interval		P - value
			Lower	Upper	
Gender	Male	1	Ref		
	Female	8.82	1.89	41.18	0.006
Religion	Hindu	1	Ref		
	Muslim	5.73	1.33	24.71	0.019
	Christian	0.48	0.08	2.91	0.426
Head of family	Self	1	Ref		
	Other	1.04	0.25	4.3	0.958
Socioeconomic status	Upper	1	Ref.		
	Middle	8.65	2.29	32.65	0.001
	Lower	6.04	1.28	28.56	0.023
Marital status	Married	1	Ref		
	Widowed/divorced/unmarried	0.7	0.24	2.01	0.503

Gender differences were particularly striking, with females showing a 8.8 times higher prevalence of cognitive impairment as compared to males . This gender disparity may reflect broader societal and biological factors, including differences in life expectancy, health behaviours, and possibly the impact of estrogen depletion post-menopause, which has been linked to cognitive decline.

Occupation status further illustrated the impact of socio-economic factors, with professionals showing the lowest impairment rates (4.2%) compared to skilled workers (27.1%) and unemployed participants .Zhong T et al.(7) reported in their study that higher educational status was significantly associated with lower cognitive impairment irrespective of occupation status . Muhammad T. et al. (8) also reported in their study, uneducated participants had higher cognitive impairment. Other studies, including works by Keshari p et al. (9), Dominguez et al. (10) and Zaninotto et al. (11), which also identified similar determinants of cognitive impairment such as female gender, lower education level, lower socio-economic status were associated with higher cognitive impairment. Longitudinal Ageing Study of India Report (LASI) 2020 (12) reported that mean composite cognition score shows 7 % male while 22% females had lower 10th percentile composite score. However, other factors, such as family type, physical activity, time spent with friends and neighbours, and left-hand grip strength, did not show significant associations with cognitive impairment in this study. Additionally, while BMI was not significantly associated with cognitive impairment, obese participants had the highest impairment rates (34%), suggesting a potential, though non-significant, trend.

This association to gender suggests that females that were older now had lower interaction with outer environment, lower opportunity for higher education and less engagement in mentally stimulating work in their younger age which may be reason for higher cognitive impairment. Lower education status, widowed, no school education associated with lower cognition score reflect some cognitive impairment as similar to our study this finding of LASI further support our study findings. While this study does not establish association, this parallels with well-established studies reinforce the validity of the associations observed and

underscore the multifactorial nature of cognitive impairment in the elderly

These findings suggest that interventions targeting education, socio-economic support, and physical health maintenance, particularly in high-risk groups such as females and individuals from lower SES backgrounds, may be effective in mitigating cognitive impairment. Future research should aim to explore these associations further and develop strategies to address the underlying causes of cognitive impairment in aging populations.

Conclusion

Cognitive impairment is statistically significantly associated with female gender and lower socioeconomic status. Regarding normal to strong right-hand grip a positive association is seen with male gender.

Recommendation

Designing new cognitive training exercises and memory games and implementation of the same to address cognitive impairment especially for females who are not working, should be engaged in mental activities from early ages to reduce chances of cognitive impairment in older ages.

Limitation of the Study

Sample size was small thus for external validity a bigger sample size study needed.

Relevance of the Study

Studying cognitive decline in elderly population of India is crucial for identifying the prevalence of cognitive impairment, understanding its associated factors that help in developing effective interventions to improve the quality of life. Cognitive decline of individuals affects not only the person but the families and healthcare systems.

Authors Contribution

All authors have contributed equally.

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Nil

Conflict of Interest

There are no conflicts of interest.

Declaration of Generative AI and AI Assisted Technologies in the Writing Process

The authors haven't used any generative AI/AI assisted technologies in the writing process.

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