ORIGINAL RESEARCH ARTICLE

A Cross-Sectional Study on Cognitive Impairment of Alcohol Users among Residents of an Urban Area of Kancheepuram District, Tamil Nadu, India

Bhuvanesh Aravindh[1*], Swetha NB[2], Sujitha P[3]

[1,2,3]Department of Community Medicine, Sree Balaji Medical College and Hospital, Chennai, India

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ABSTRACT

Background: This community-based cross-sectional study assessed cognitive impairment among alcohol users in an urban setting in South India. Alcohol use disorder is frequently associated with cognitive impairment, which may adversely affect treatment engagement and functional outcomes. However, community-level evidence from urban Indian populations remains limited. The objective was to estimate the prevalence of cognitive impairment among alcohol users in the urban area of Kancheepuram district and to examine its association with the severity of alcohol use.

Methodology: The study was conducted among 260 adult male alcohol users residing in the urban field practice area of a medical college in Anakaputhur, Tamil Nadu. Participants were selected through simple random sampling using the electoral list. Alcohol use severity was assessed using the Alcohol Use Disorder Identification Test, and cognitive function was evaluated using the Montreal Cognitive Assessment. Data were analyzed using bivariate and multivariable logistic regression methods.

Results: Cognitive impairment was present in 30.8% of alcohol users in study population. Increasing severity of alcohol use was associated with worsening cognitive functioning, while higher age and lower educational attainment were associated with greater cognitive vulnerability.

Conclusions: Cognitive impairment is a common finding among community-dwelling alcohol users and shows a clear association with alcohol use severity. Incorporating routine cognitive screening into community-based alcohol-related services may facilitate early identification and inform appropriate intervention strategies.

Keywords: Alcohol use disorder, Cognitive impairment, Alcohol use severity, AUDIT, Montreal Cognitive Assessment, Community-based study, Urban India

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***Correspondence:** Bhuvanesh Aravindh (Email: drbhuvanesharavindh@gmail.com)

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INTRODUCTION

Alcohol use disorder (AUD) poses a serious challenge to population health worldwide. Global estimates show that alcohol consumption contributes substantially to early mortality and long-term health loss, with 2.8 million deaths which corresponds to 2·2% of total age-standardized deaths among females and 6.8% among males in 2016.[1] In India about 19% of current Alcohol users are found to be consuming alcohol in dependent pattern with among 2.7% of general population between the age of 10 years to 75 years found to be in dependent pattern accounting for 2.9 crore individuals.[2]

Alcohol use disorder is frequently associated with cognitive impairment, particularly affecting executive, attentional, memory, and visuospatial domain.[3] Evidence further suggests that alcohol-related cognitive impairment frequently persists despite abstinence. Pulichumakal Devasia M et al.[4] reported that in their study of male inpatients with alcohol use disorder, a large majority (86.7 %) exhibited global cognitive impairment and that greater subjective craving was significantly associated with lower cognitive scores, highlighting a strong relationship between cognitive dysfunction and craving severity in this population.

A study conducted by Shah K et al reported that patients with severe alcohol dependence had significantly lower MoCA and FAB scores and demonstrated significant negative correlations between dependence severity and cognitive function, underscoring the need to integrate routine cognitive assessment and rehabilitation into primary care.[5]

A recent Indian study by Ali A et al reported that alcohol use was significantly associated with a higher risk of cognitive impairment among older adults, underscoring the importance of early cognitive screening and lifestyle modification to promote healthy ageing and support Sustainable Development Goal 3.[6]

Research by Gupta A et al indicates that brief and targeted cognitive screening tools can facilitate the identification of clinically meaningful cognitive deficits among alcohol users in routine clinical and community settings, particularly in resource-limited environments where comprehensive neuropsychological testing is not feasible.[7]

Evidence from India reflects a comparable burden of alcohol-related cognitive impairment. Sachdeva A et al reported that subtle alcohol-related cognitive deficits may persist even after successful detoxification and in the absence of overt dementia, with complete cognitive recovery not achieved in a substantial proportion of individuals with alcohol dependence.[8]

A study by Madhusudhan S et al[9] demonstrated that cognitive deficits are highly prevalent among individuals with alcohol dependence syndrome, with impairments observed across multiple domains including speed of processing, attention, working memory, visuospatial abilities, executive functions, and problem-solving skills. A follow up study by Dwivedi LCAK et al[10] reported that patients with alcohol dependence syndrome exhibited significant cognitive deficits across multiple domains compared to healthy controls, which showed marked improvement over 24 weeks of abstinence.

Although alcohol related cognitive impairment has been well documented in hospital based and treatment seeking populations, evidence from community settings in India remains limited. Most Indian studies are confined to clinical samples and often do not use standardized cognitive assessments, limiting the generalizability of their findings. Furthermore, few community-based studies have examined cognitive impairment alongside validated measures of alcohol use severity, restricting understanding of its true burden among alcohol users in urban Indian settings.

In view of the limited community-based evidence on alcohol related cognitive impairment in India, the present study was undertaken to address this gap. The objectives of the study were to estimate the prevalence of cognitive impairment among alcohol users in the urban area of Kancheepuram district and also to examine the association between the severity of alcohol use and cognitive impairment among alcohol users in this urban population.

METHODOLOGY

A community-based cross-sectional study was done to evaluate cognitive impairment among alcohol users and to examine its association with the severity of alcohol use. The research was undertaken in the urban field practice area attached to a medical college located in Anakaputhur, a town within Kancheepuram district of Tamil Nadu during October 2024 to October 2025. The study area comprises four municipal wards with a total population of 42,597, of whom 22,158 are males and 20,439 are females.

The study included adult men aged 18 years and above who were residing in the selected study area during the period of data collection. Adult males were selected as the study population considering the higher prevalence of alcohol use in this group and to ensure uniformity in assessment.

Sample Size Estimation: To determine the prevalence of cognitive impairment among one alcohol user, the sample size was computed. The required sample size was determined by applying a prevalence-based estimation method, using a previously reported cognitive impairment rate of 62% from a study conducted by Ghogare AS et al[11]. The calculated sample size using an absolute precision of 6% (to balance between feasible sample size and better precision) at 95% confidence level was 251, which was rounded up to 260 participants

Sampling Method: A simple random sampling technique was adopted. The list of adult males more than 18 years of age residing in these four wards were identified from the electoral rolls and 260 eligible participants were selected.

Data Collection Tools and Procedure: Data collection was carried out through face-to-face interviews conducted at the participants residences by trained investigators. Interviews were conducted in the local language to ensure clarity and participant comfort.

Two standardized measurement tools were employed for data collection:

Alcohol Use Disorder Identification Test (AUDIT): This tool was applied to quantify the extent of alcohol use and to characterize drinking behaviour. Severity levels were assigned based on cumulative AUDIT scores in line with recommended criteria. In the present study, AUDIT scores were categorized according to the following WHO cut-offs: Zone I (0-7) - Low-risk drinking or abstinence; Zone II (8-15) - Hazardous drinking; Zone III (16-19) - Harmful drinking; and Zone IV (20-40) - Possible alcohol dependence[12].

Montreal Cognitive Assessment (MoCA): The MoCA scale was utilized to evaluate cognitive abilities across several domains such as attention, executive functioning, memory, language, visuospatial skills, and orientation. Scores below the accepted benchmark indicated impaired cognitive function

Adequate privacy was ensured during interviews, and sufficient time was given to each participant to complete the assessment without interruption. The total MoCA score ranges from 0 to 30, with higher scores indicating better cognitive performance. In accordance with standard recommendations, a score <26 was considered indicative of cognitive impairment in this study.

The assessments were conducted as interviewer-administered interviews in Tamil. The original English versions of AUDIT and MoCA were administered, with items orally translated and explained in Tamil by trained interviewers, ensuring conceptual equivalence with the original instruments and adequate participant comprehension.

Socioeconomic status was assessed using the Modified Kuppuswamy Scale (2025), which classifies families based on the education and occupation of the head of the household and the monthly family income[13].

Eligibility Criterias: Adult males aged ≥18 years who were residents of the study area and reported alcohol consumption within the preceding 12 months were included in the study.

The study was restricted to adult males because the prevalence and patterns of alcohol use are substantially higher among men in the study setting, and inclusion of only males ensured homogeneity of the study population and minimized gender-related confounding in the assessment of alcohol use severity and cognitive impairment. This approach also facilitated more accurate estimation of associations within the predominant alcohol-using group in the community.

Alcohol-dependent individuals currently undergoing treatment in rehabilitation or de-addiction centres were excluded.

Data Management and Statistical Analysis: The collected information was coded, entered, and processed using SPSS version 22. Summary measures were generated to describe the sociodemographic profile of the participants and to determine the extent of cognitive impairment within the study population. The relationship between alcohol use severity and cognitive performance was evaluated using Pearson's correlation method. Since the scores obtained from the AUDIT and MoCA tools followed a normal distribution, they were treated as continuous variables for analysis. Variables with a bivariate association at a p value < 0.05 were entered into the multivariable logistic regression model.

Ethical Consideration: Permission to conduct the study was granted by the Institutional Ethics Committee of Sree Balaji Medical College and Hospital (Ref No. 002/SBMCH/IHEC/2024/2331).

RESULTS

Sociodemographic Profile of the Participants: The study comprised 260 adult male alcohol users from the urban field practice area. Participants were broadly distributed across age groups, with the largest proportion belonging to the 40-60-year category as shown in Table 1. Most participants were married. With respect to educational attainment, Secondary education emerged as the most common level of education, followed by Higher. Only a small proportion of participants had primary education. In terms of socioeconomic status, most participants belonged to the upper and middle classes while a small proportion belonged to the lower socioeconomic group.

Footnote: Alcohol use risk was classified using the Alcohol Use Disorder Identification Test (AUDIT) with scores categorized as low risk (0-7), risky (8-15), harmful (16-19), and severe (≥20). Cognitive impairment was assessed using the Montreal Cognitive Assessment (MoCA), with a score <26 considered indicative of cognitive impairment. Socioeconomic status was assessed using the Modified Kuppuswamy Scale.

Alcohol consumption patterns showed that nearly two-thirds of the participants consumed alcohol at levels considered low risk. In contrast, a notable minority demonstrated progressively concerning patterns of use, with 12.7% reporting risky intake, 17.3% showing harmful use, and 5.8% meeting criteria suggestive of severe use or probable dependence.

Table 1: Distribution of Sociodemographic Variables, Alcohol Use Severity, and Cognitive Impairment among Alcohol Users (n = 260)

Variable	Participants (%)
Age (Years)	
20-40	85 (32.7)
40-60	92 (35.4)
>60	83 (31.9)
Marital Status	
Single	55 (21.2)
Married	205 (78.8)
Education	
Graduate	66 (25.4)
Intermediate or Diploma	58 (22.3)
High School Certificate	28 (10.8)
Middle School Certificate	42 (16.2)
Primary School Certificate	57 (21.9)
Illiterate	9 (3.5)
Socio Economic Status	
Upper Middle	48 (18.5)
Lower Middle	94 (36.2)
Upper Lower	109 (41.9)
Lower	9 (3.5)
Alcohol Use Risk Zone	
Low Risk	167 (64.2)
Risky	33 (12.7)
Harmful	45 (17.3)
Severe/Addiction	15 (5.8)
Cognitive Impairment	
Yes	80 (30.8)
No	180 (69.2)

Assessment of cognitive functioning revealed that impairment was relatively common in the study population, as 30.8% of individuals were identified with cognitive deficits based on their MoCA performance.

As shown in Table 2. Bivariate analysis indicated a statistically significant relationship between age and cognitive impairment reflecting an age-related increase in impairment among alcohol users. Educational level was also significantly associated with cognitive impairment suggesting a protective influence of education. Socioeconomic status was significantly associated with cognitive impairment. A significant association was further noted between the extent of alcohol consumption and cognitive impairment with harmful and severe alcohol use linked to a substantially greater burden of impairment than low-risk drinking. In contrast, marital status was not significantly associated with cognitive impairment in the bivariate analysis.

In Multivariate analysis variables that were significant at the bivariate level were analyzed to identify independent predictors of cognitive impairment. Advancing age remained significantly associated with impairment. Educational attainment continued to show an independent effect and after adjusting for other factors, lower and middle socioeconomic status remained independently associated with a higher likelihood of cognitive impairment. Severity of alcohol use was also independently linked to cognitive impairment, with severe alcohol consumption showing a significant association when contrasted with low-risk use suggesting that cognitive effects become more pronounced at higher levels of alcohol exposure.

The findings indicate that older age, lower educational status, socio economic status and greater severity of alcohol use are independently associated with cognitive impairment among alcohol users. In contrast, marital status was not significantly associated after adjustment.

Table 2: Determinants of Cognitive Impairment in Alcohol Users Based on Bivariate and Multivariable Analysis (n = 260)

Variable	Cognitive Impairment		Univariate Analysis		Multivariate Analysis	
	Yes (n=80)(%)	No (n=180)(%)	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Age (years)						
>60	43 (53.8)	40 (22.2)	29.38 (8.59-100.52)	**<0.001**	2.13 (1.10-4.39)	**0.001**
40-60	34 (42.5)	58 (32.2)	16.02 (4.70-54.68)		1.11 (1.01-1.85)	**0.034**
20-40	3 (3.8)	82 (45.6)	Ref.		Ref.	-
Marital Status						
Single	20 (25)	35 (19.4)	1.38 (0.74–2.58)	0.31	-	-
Married	60 (75)	145 (80.6)	Ref.		-	-
Education						
Primary	46 (57.5)	20 (11.1)	15.72 (6.91-35.74)	**<0.001**	26.42 (10.30-67.78)	**<0.001**
Secondary	22 (27.5)	78 (43.3)	1.93 (0.88-4.23)		17.14 (6.02-48.77)	**<0.001**
Higher	12 (15)	82 (45.6)	Ref.		-	-
Socio-Economic Status						
Lower	3 (3.8)	6 (3.3)	1.34 (0.29-6.19)	**0.033**	0.163(0.04-0.74)	**0.019**
Middle	24 (30)	85 (47.2)	1.99 (0.94-4.25)		0.09(0.02-0.52)	**0.007**
Upper	53 (66.3)	89 (49.4)	Ref		-	-
Alcohol Risk Zone						
Severe / Addiction	12 (15)	3 (1.7)	107.33 (23.8-483.4)	**<0.001**	1.51 (1.03-8.42)	**<0.001**
Harmful	40 (50)	5 (2.8)	214.67 (62.4-739.1)		1.00 (1.00-3.25)	**0.029**
Risky	22 (27.5)	11 (6.1)	53.67 (18.04-159.6)		0.78 (0.25-1.02)	0.96
Low Risk	6 (7.5)	161 (89.4)	Ref.		Ref.	-

Correlation between Severity of Alcohol Use and Cognitive Performance

The study shows relationship between severity of alcohol use and cognitive performance using Pearson's correlation analysis. The AUDIT score demonstrated a strong negative correlation with the cognitive performance (MoCA) score ($r = -0.851$), and this relationship was statistically significant ($p < 0.001$).

The findings show that higher levels of alcohol use severity were associated with poorer cognitive performance among the study participants. As alcohol addiction scores increased, cognitive scores showed a corresponding decline. The results demonstrate a notable association between higher levels of alcohol use and poorer cognitive functioning in the study population. However, since the analysis is correlational in nature, no conclusions regarding causality can be drawn.

Table 3: Distribution of Cognitive Scores Across Levels of Alcohol Addiction

Statistics	AUDIT Score vs MoCA Score
Pearson's Correlation	-0.851
P value	<0.001

The scatter diagram in Table 3. presents individual cognitive scores plotted against corresponding alcohol addiction scores. Across the range of observations, participants with lower alcohol addiction scores generally clustered at higher cognitive score values. In contrast, as alcohol addiction scores increased, cognitive scores tended to appear at lower levels.

The overall distribution reflects a pattern in which higher alcohol addiction severity coincides with poorer cognitive performance. This graphical representation supports the analytical results of the study by illustrating that greater alcohol involvement is linked with reduced cognitive functioning among the participants.

DISCUSSION

The proportion of participants identified with cognitive impairment in this study (30.8%) was comparatively lower than figures reported from hospital-based studies conducted in India. For instance, Ghogare and colleagues reported cognitive impairment in 62% of individuals with alcohol dependence who were receiving care at a tertiary-level facility in Central India. The higher prevalence reported by Ghogare AS et al may be attributed to the hospital-based setting, which likely included individuals with more severe dependence and longer drinking histories than those in the present community-based study.[11] A study by Mishra R et al[14] reported cognitive impairment in 19.1% of individuals with alcohol dependence using the Montreal Cognitive Assessment (MoCA). In comparison, the prevalence observed in the present study is higher. Evidence from a UK community mental health service study by Rao R et al[15] demonstrated a notably high occurrence of cognitive deficits among older individuals with alcohol use disorders, with 76% of participants falling below the Addenbrooke's Cognitive Assessment cut-off suggestive of dementia. In comparison, the prevalence observed in the present study was considerably lower, a difference that is likely attributable to the older age profile and clinical service-based setting of the study by Rao R et al[15]. A study done by Muhammad T et al[16] reported older adults who consumed alcohol had a significantly higher likelihood of cognitive impairment, which is similar to the findings of the present study.

While the study by Karuppaiah C et al[17] showed similarities with the present study in terms of significant correlation between alcohol consumption and Cognitive impairment, it differs with the present study as it show no significant correlation with age. A study by Vijay P et al[18] demonstrated significant cognitive deficits among individuals with alcohol dependence, similar to the findings of the present study assessed using the Montreal Cognitive Assessment (MoCA) scale, despite employing different cognitive assessment tools such as the Mini-Mental State Examination (MMSE), Frontal Assessment Battery (FAB), Barratt Impulsiveness Scale, Stroop Test, and the Wisconsin Card Sorting Test (WCST). Another study by Ghai P et al[19] demonstrated significantly poorer cognitive performance among alcohol-dependent middle-aged men, with lower MoCA and MMSE scores and marked impairment in executive, visuoconstructional, and recall domains, alongside reduced serum thiamine levels. In comparison, the present study similarly identified a substantial burden of cognitive impairment among adult male alcohol users in an urban community setting using MoCA screening. In a study by Mathew M et al[20] using the MoCA scale revealed that 89% of patients with alcohol use disorder had mild cognitive impairment. In contrast, the present study found a lower prevalence (30.8%), which may be attributed to differences in the study population. The present study included individuals with alcohol use ranging from low-risk use to dependence in a community setting, whereas the former study assessed only AUD patients in a clinical setting, who are more likely to exhibit cognitive impairment. While study by Ravindran OS et al[21] explored the similar significant cognitive deficits among individuals with alcohol dependence, with more pronounced impairment observed in those with other substance uses like cannabis use, particularly affecting processing speed, working memory, visuospatial ability, and verbal learning. In the study by Annita TSM et al[22] Cognitive impairment was identified in 28.57% of participants on the Trail Making Test (TMT), 36.73% on the Benton Visual Retention Test (BVRT), and 65.31% on the Wisconsin Card Sorting Test (WCST). In comparison, the present study assessed cognitive impairment using the MoCA scale and observed a lower prevalence, which may be explained

by differences in assessment tools and study populations. A study by Nachiyar ST et al[23] similar to the present study reported a high prevalence of cognitive impairment among patients with alcohol dependence, with nearly two-thirds showing low MoCA scores, and added that poorer cognitive functioning was associated with higher relapse rates at short-term follow-up.

These results emphasize the need for early identification of cognitive deficits among alcohol users, particularly among older individuals and those with lower educational levels. Integrating routine cognitive screening into community-based alcohol use interventions may facilitate timely detection and management. Addressing harmful drinking patterns through targeted prevention and treatment strategies could play a crucial role in mitigating cognitive impairment and improving overall quality of life in this vulnerable population.

Strengths and Limitations

A major strength of this study is its community-based design, which allows estimation of cognitive impairment among alcohol users outside hospital or treatment seeking settings, thereby improving external validity and providing insight into an under represented population. Simple random sampling from electoral rolls minimized selection bias and enhanced representativeness, while the adequate sample size improved precision and statistical power. The use of validated and widely used tools the Alcohol Use Disorder Identification Test (AUDIT) for alcohol use severity and the Montreal Cognitive Assessment (MoCA) for cognitive function strengthens the reliability of the findings. Assessment of both alcohol use severity and cognitive function enabled examination of a dose 2response relationship, enhancing biological plausibility. Multivariable logistic regression allowed adjustment for potential confounders and identification of independent associations, while correlation analysis provided complementary evidence supporting the relationship between alcohol severity and cognitive performance.

Several limitations must be acknowledged. The cross-sectional design precludes causal or temporal inference, and it cannot be determined whether cognitive impairment preceded or resulted from alcohol use. Alcohol use was self-reported, introducing potential recall and social desirability bias, although the use of AUDIT may have mitigated this. Inclusion of only adult male's limits generalizability to females. Cognitive impairment was assessed using a screening tool rather than diagnostic evaluation, and non-response bias cannot be excluded.

Conclusion

This study highlights cognitive impairment as an important yet under-recognized concern among alcohol users in community settings. The findings support the integration of routine cognitive screening into urban primary healthcare services and community-based de-addiction outreach programs, particularly for individuals with higher alcohol use severity, older age, and lower educational attainment. Incorporating cognitive assessment into existing alcohol-related interventions may facilitate early identification of cognitive difficulties and enable more appropriate, individualized support. These results underscore the need for strengthening community level strategies that address cognitive health as part of comprehensive alcohol harm reduction efforts in urban Indian settings.

Individual Authors' Contributions: BBA Conceived and planned the research, carried out data collection, undertook the statistical analyses, and prepared the initial draft of the manuscript. **SNB** Supervised the data collection and provided critical review of the manuscript. **SP** Offered methodological oversight and critically revised the manuscript.

Availability of Data: The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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