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COGNITIVE IMPAIRMENT IN ALCOHOL DEPENDENCE SYNDROME IN EARLY DETOXIFICATION PHASE

Psychiatry

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ABSTRACT

Background: Cognitive impairment is a frequently overlooked yet clinically significant consequence of Alcohol Dependence Syndrome (ADS), adversely affecting treatment adherence, rehabilitation outcomes, and quality of life. **Aim:** To assess the nature and extent of cognitive impairment in individuals with ADS and examine its association with clinical parameters such as severity, duration of alcohol use, age of onset, and family history. **Materials and Methods:** This was a cross-sectional, case-control study conducted at PESIMSR, Kuppam, from May 2023 to October 2024. A total of 138 participants (69 ADS patients and 69 matched healthy controls) were assessed. Instruments included the Severity of Alcohol Dependence Questionnaire (SADQ), Montreal Cognitive Assessment (MoCA), Frontal Assessment Battery (FAB), PGI Memory Scale, Trail Making Test (TMT A/B), and Digit Symbol Substitution Test (DSST). Statistical analysis was performed using SPSS v23.0, with ANOVA and Chi-square tests applied. **Results:** ADS patients demonstrated significantly lower scores across all cognitive domains. Mean MoCA scores were 22.3±3.4 in cases vs. 26.7±2.1 in controls ($p<0.001$). FAB scores averaged 11.6±2.3 in cases vs. 14.9±1.4. Deficits were pronounced in delayed recall, attention, and visuospatial domains. Higher SADQ scores, early age of onset, longer duration of use, and positive family history were associated with greater impairment. **Conclusion:** Cognitive dysfunction in ADS is multidimensional and strongly influenced by clinical variables. Routine cognitive screening and targeted cognitive rehabilitation are essential components of comprehensive ADS management.

KEYWORDS

Alcohol Dependence Syndrome, Cognitive Impairment, MoCA, PGI Memory Scale, Executive Dysfunction, Neuropsychology

INTRODUCTION

Alcohol Dependence Syndrome (ADS) is a chronic psychiatric condition associated with profound functional and cognitive impairments. Globally, alcohol use disorders contribute significantly to disability-adjusted life years (DALYs), accounting for nearly 5% of the global burden of disease according to WHO estimates(1). Cognitive impairment in ADS is a major contributor to poor treatment outcomes, increased relapse rates, and reduced social functioning(2).

Alcohol-induced cognitive deficits span multiple domains including attention, memory, executive functions, visuospatial skills, and processing speed(3,4). These deficits stem from neurotoxic effects of alcohol, nutritional deficiencies (particularly thiamine), neuro-inflammation, and disruption of neurotransmitter systems such as GABA and dopamine(5,6). Neuroimaging studies reveal structural brain changes, particularly in the frontal and temporal lobes, which correlate with executive dysfunction and memory loss(7).

Studies have shown that even in the absence of Wernicke–Korsakoff syndrome, ADS patients may present with subtle to moderate cognitive deficits(8). Despite their prevalence and clinical relevance, these impairments often go undetected in routine psychiatric practice(9). Furthermore, the extent of cognitive dysfunction may vary with clinical parameters such as age of onset, duration and severity of alcohol use, and family history(10).

This study aims to assess cognitive impairment in individuals with ADS using culturally appropriate neuropsychological tools and examine its association with key alcohol-related variables. It seeks to bridge the gap in the Indian psychiatric literature by providing robust, clinic-based evidence on cognitive profiles in ADS.

MATERIALS AND METHODS

Study Design and Setting

This was a cross-sectional case-control study conducted in the Department of Psychiatry at PES Institute of Medical Sciences and Research (PESIMSR), Kuppam, Andhra Pradesh, between May 2023 and October 2024.

Participants

A total of 138 male participants were recruited — 69 diagnosed ADS inpatients (cases) and 69 age- and sex-matched healthy controls. ADS was diagnosed as per ICD-10 DCR criteria following at least two weeks of abstinence. Controls were non-alcohol-dependent attendants of medical/surgical inpatients.

Inclusion Criteria

- Age between 18 and 50 years
- Minimum education: 7th standard
- For cases: Diagnosed with ADS (ICD-10 DCR), minimum 2 weeks abstinent
- For controls: No current or past history of alcohol dependence

Exclusion Criteria

- Comorbid psychiatric disorders (e.g., schizophrenia, bipolar disorder)
- History of dementia, intellectual disability, or other neurocognitive disorders
- Use of psychoactive substances (except nicotine)
- Alcohol-induced psychotic or mood disorders

Study Tools

1. Sociodemographic and Clinical Proforma – age, education, occupation, alcohol history, medical comorbidities.
2. Severity of Alcohol Dependence Questionnaire (SADQ) – 20-item scale measuring alcohol dependence severity(11).
3. Montreal Cognitive Assessment (MoCA) – Screens for global cognitive impairment across multiple domains(12).
4. Frontal Assessment Battery (FAB) – Brief measure of executive functioning and frontal lobe activity(13).
5. PGI Memory Scale (PGIMS) – Indian tool assessing verbal and visual memory using dysfunction scoring(14).
6. Trail Making Test (TMT-A and B) – Measures attention, processing speed, and executive control(15).
7. Digit Symbol Substitution Test (DSST) – Assesses psychomotor speed, visual-motor coordination, and working memory(16).

Ethical Considerations

Ethical approval was obtained from the Institutional Ethics Committee of PESIMSR. Written informed consent was taken from all participants.

Statistical Analysis

Data were analyzed using SPSS version 23. Continuous variables were presented as means and standard deviations; categorical variables as frequencies and percentages. Intergroup comparisons used independent t-tests or ANOVA for continuous data and Chi-square tests for categorical variables. Significance was set at $p < 0.05$.

RESULTS

A total of 138 participants were included: 69 male inpatients with Alcohol Dependence Syndrome (ADS) and 69 age- and sex-matched healthy controls. The groups were comparable in terms of sociodemographic variables, with no significant differences in age, education, or socioeconomic status ($p > 0.05$).

Cognitive Scores in ADS vs. Controls

Across all cognitive domains, the ADS group demonstrated significantly lower performance than controls. MoCA total scores were markedly lower in ADS participants (mean = 22.3 ± 3.4) compared to controls (mean = 26.7 ± 2.1, $p < 0.001$). Similarly, FAB total scores were reduced in ADS patients (11.6 ± 2.3 vs. 14.9 ± 1.4, $p < 0.001$). Deficits were also seen in PGI Memory subdomains, TMT completion time, and DSST scores.

Table 1. Comparison of Neuropsychological Scores Between ADS and Controls

Test	ADS (Mean ± SD)	Controls (Mean ± SD)	p-value
MoCA Total Score	22.3 ± 3.4	26.7 ± 2.1	<0.001
FAB Total Score	11.6 ± 2.3	14.9 ± 1.4	<0.001
TMT-A (sec)	39.1 ± 7.6	26.1 ± 4.6	<0.001
TMT-B (sec)	146.1 ± 70.7	91.9 ± 41.8	<0.001
DSST (Attention)	51.2 ± 7.6	73.4 ± 14.4	<0.001
DSST (Processing Speed)	52.2 ± 8.2	72.7 ± 12.2	<0.001

Significant impairments were also observed in PGI subdomains like delayed recall (62.3% with significant dysfunction), visual retention (60.3%), and attention (58.8%).

Association with Clinical Variables

Severity of alcohol dependence (SADQ scores), longer duration of alcohol use, earlier age of onset, and positive family history were significantly associated with greater cognitive impairment ($p < 0.05$). No significant associations were observed with comorbid physical illnesses such as hypertension or diabetes.

Table 2. Associations Between Cognitive Scores and Alcohol-Related Variables in ADS Group

Variable	MoCA Score (Mean ± SD)	FAB Score (Mean ± SD)	p-value
SADQ (Mild)	24.1 ± 2.1	13.1 ± 1.7	Ref
SADQ (Moderate)	22.5 ± 2.9	11.9 ± 2.0	<0.01
SADQ (Severe)	20.4 ± 3.5	10.3 ± 2.2	<0.001
Duration of Use ≥10 yrs	21.1 ± 3.2	10.8 ± 2.0	<0.01
Age of Onset <20 yrs	20.7 ± 3.6	10.6 ± 2.3	<0.05
Family History (Yes)	21.4 ± 3.5	11.0 ± 2.1	<0.05

DISCUSSION

This study confirms that cognitive impairment in individuals with Alcohol Dependence Syndrome (ADS) is multidimensional and significantly more prevalent than in healthy controls. Patients with ADS exhibited deficits across all tested domains, including global cognition, memory, executive functioning, attention, and processing speed.

MoCA (Global Cognition)

MoCA scores in the ADS group were significantly lower (mean = 22.3 ± 3.4) than in controls (26.7 ± 2.1), indicating impairment in global cognition. This aligns with prior Indian studies such as Mukherjee et al. (2020)(19)and Rajula & Narayan (2024)(20), both of which demonstrated similarly reduced MoCA scores in ADS populations. A study by Madhusudhan et al. (2021)(21)also found mean MoCA scores of 23.5 in ADS patients after 4 weeks of abstinence, suggesting that cognitive deficits persist despite short-term detoxification.

FAB (Executive Functioning)

Lower FAB scores in the ADS group (11.6 ± 2.3) reflect significant executive dysfunction. Similar deficits were reported by Adhikari et al. (2016)(10)and Maharjan et al. (2022)(17), with common impairments in conceptualization, programming, and mental flexibility. These executive deficits are associated with disrupted frontal lobe activity, which affects planning, inhibition, and goal-directed behavior—all crucial for rehabilitation success.

PGI Memory Scale

The PGI Memory Scale revealed pronounced dysfunction in delayed recall (62.3%), visual retention (60.3%), and attention (58.8%). These findings closely resemble those of Adhikari et al. (2016)(10)and Tripathi et al. (2018), who observed widespread memory impairment in Indian ADS cohorts. Such deficits have been attributed to hippocampal atrophy and thalamic dysfunction associated with chronic alcohol exposure(4,5).

TMT-A and TMT-B (Attention, Processing Speed, Cognitive Flexibility)

The ADS group took significantly longer to complete TMT-A and B, with TMT-B particularly affected (mean = 146.1 sec vs. 91.9 sec in controls). This mirrors results from Dhiman et al. (2021) and Ghai et al. (2023)(20), and reflects impaired cognitive flexibility, task-switching, and processing speed—key indicators of frontal-executive dysfunction. Studies have consistently shown TMT-B to be more sensitive to alcohol-related cognitive decline than TMT-A.

DSST (Processing Speed, Working Memory)

DSST scores were markedly lower in the ADS group (mean ~51–52) versus controls (~73). Similar results have been found in studies by Sharma et al. (2017) and Bernardin et al. (2014)(9). These results reflect slowed processing speed and impaired working memory, common consequences of diffuse cerebral dysfunction due to chronic alcohol intake.

Cognitive Recovery Beyond Early Abstinence

Although our study focused on patients abstinent for at least two weeks, emerging evidence suggests that some domains of cognition—such as attention and psychomotor speed—may begin to recover within 4–8 weeks of abstinence (Stavro et al., 2013)【2】. A 12-month longitudinal study by Mulhauser et al. (2018)【22】reported significant improvements in executive function and memory over time, though many patients failed to reach normative levels. Similarly, Mellentin et al. (2021)【18】highlighted persistent deficits even after prolonged abstinence (>1 year), particularly in executive functioning and verbal memory.

These studies emphasize that while abstinence promotes partial cognitive recovery, improvements are domain-specific and often incomplete without targeted intervention. Thus, long-term follow-up and cognitive remediation programs are essential to maximize recovery.

Clinical Implications

The consistent deficits observed across all tools suggest that a multi-domain cognitive screening approach (MoCA, FAB, PGI, TMT, DSST) should be integrated into standard ADS management. Early detection enables timely intervention, such as cognitive remediation, structured psychoeducation, and relapse prevention strategies tailored to neurocognitive profiles. Tools like MoCA and DSST, being brief and sensitive, are especially useful in routine clinical settings.

Strengths and Limitations

A major strength of this study is the comprehensive assessment of cognition using multiple standardized tools in a demographically matched control design. The findings also reinforce the relevance of locally validated instruments like the PGI Memory Scale. Limitations include the exclusive inclusion of male participants, the cross-sectional design, and lack of follow-up to assess recovery trajectories. Future longitudinal and neuroimaging studies are warranted to map brain-behavior correlations and track cognitive recovery post-abstinence.

CONCLUSION

This study provides robust evidence that cognitive impairment in Alcohol Dependence Syndrome (ADS) is prevalent, multidomain, and significantly associated with clinical variables such as severity, duration of alcohol use, early onset, and family history. Specific deficits were observed in global cognition, executive function, memory, attention, and processing speed, as measured by MoCA, FAB, PGI Memory Scale, TMT, and DSST. Importantly, some of these impairments persist even after two weeks of abstinence, highlighting the need for longer-term follow-up. Routine cognitive screening using culturally appropriate tools should be integrated into standard ADS care to guide timely cognitive rehabilitation, enhance treatment adherence, and improve long-term recovery outcomes.

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