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Cognitive Impairments and Dysregulated Affect in Chronic Substance Users: Insights from Empirical Evidence

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ABSTRACT

Introduction: Adolescence and young adulthood are critical periods of neurocognitive, psychological, and emotional development. In Assam, the rising prevalence of substance use among youth has become a pressing public health concern, shaped by rapid socio-cultural transitions and limited mental health awareness. Early initiation of substance use is strongly linked to impairments in attention, working memory, executive functioning, and emotion regulation. However, empirical evidence on these deficits among Assamese youth remains scarce. This study examined the cognitive and emotional regulation difficulties associated with Substance Use Disorder (SUD).

Methodology: A cross-sectional, comparative study was conducted with 320 participants (160 youths with clinically identified SUD and 160 matched healthy controls). Substance use severity was assessed using WHO-ASSIST, emotion regulation with the Difficulties in Emotion Regulation Scale (DERS), and cognitive functioning with the Trail Making Test (TMT-A and TMT-B) and a Cognitive Assessment Questionnaire. Independent t-tests evaluated group differences, and MANOVA assessed multivariate effects of substance use on cognition.

Results: Youths with Substance Use Disorder demonstrated significantly poorer cognitive performance across all measures compared to healthy controls ($p<.001$), with large effect sizes observed for attention, processing speed, and executive functioning. Deficits were particularly evident on TMT-A and TMT-B, indicating impairments in processing speed, cognitive flexibility, working memory, inhibitory control, and sustained attention. Additionally, youths with SUD reported significantly greater difficulties in emotion regulation, particularly in impulse control, goal-directed behavior, and emotional clarity ($p<.001$).

Conclusion: Substance use among youths in Assam is associated with marked cognitive impairments and significant emotion regulation difficulties, highlighting the need for early screening, preventive strategies, and integrated interventions tailored to young populations.

Keywords: Substance Use Disorder; Youth; Cognitive Impairment; Emotion Regulation; Assam

INTRODUCTION

Substance use disorder (SUD) is a significant healthcare concern during childhood and early adulthood because this developmental period involves ongoing brain maturation and heightened vulnerability to risk-taking behaviors (Crews et al., 2007; Squeglia et al., 2009). Neurodevelopmental researches suggest exposure to psychoactive substances during this stage disrupts prefrontal and frontostriatal neural systems responsible for executive control, decision-making, and self-regulation (Goldstein & Volkow, 2011). Numerous empirical

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studies show that people with SUD have problems with retaining information, focus, speed of processing, and functioning as executives, with regulatory deficiencies being most apparent (Stavro et al., 2013; Verdejo-García et al., 2018). Performance-based neuropsychological measures such as the Trail Making Test consistently show slowed processing speed and reduced cognitive flexibility among people with drug use problem (Fernández-Serrano et al., 2011; Scott et al., 2018). Alongside cognitive deficits, emotion regulation difficulties are increasingly recognized as a core feature of SUD. Difficulties in impulse control, goal-directed behavior under distress, and limited access to adaptive regulation strategies have been strongly linked to substance use initiation, maintenance, and relapse (Gratz & Roemer, 2004; Fox et al., 2007; Wills et al., 2017). However, evidence regarding emotional awareness remains mixed, with some studies reporting preserved awareness alongside impaired behavioral regulation, particularly among younger samples (Wilcox et al., 2016). In the Indian context, national data indicate a substantial burden of substance use among youths, with early initiation and polysubstance use being common (Ministry of Social Justice and Empowerment [MoSJE], 2019). Importantly, Northeast India exhibits disproportionately higher prevalence of alcohol, opioid, and sedative use, influenced by geographic proximity to international drug trafficking routes, sociocultural acceptance of alcohol use, and limited access to mental health services (Saikia et al., 2020; MoSJE, 2019). Despite this elevated risk, empirical studies examining neurocognitive and emotion regulation correlates of SUD among youths in Northeast India remain scarce, with most research focusing on prevalence and psychosocial factors rather than underlying psychological mechanisms (Debbarma, Srivastava & Saikia, 2023).

This study fills this significant gap by investigating substance use severity, emotion regulation, and cognitive functioning among youths with SUD and healthy controls from Northeast India, using both univariate and multivariate analytic approaches to identify disorder-specific neuropsychological profiles.

METHODOLOGY

Research Design

The study used a cross-sectional, comparative methodology to examine differences in substance use severity, emotion regulation, and cognitive functioning between Youths suffering from substance use disorder (SUD) versus controls who are healthy without diagnosed SUD. This design was selected to allow systematic comparison of psychological and neurocognitive outcomes across groups within a single assessment period.

Participants

The sample comprised 320 youths, including 160 participants with clinically identified substance use disorder (SUD) and 160 age- and gender-matched healthy controls, and was collected using purposive sampling. Participants were recruited from rehabilitation and de-addiction centers, as well as community settings, in Northeast India, including selected regions of Assam and Arunachal Pradesh. The age range of participants was 15–30 years, consistent with national definitions of youth and evidence indicating heightened vulnerability to substance-related cognitive and emotional disturbances during this developmental period (Ministry of Social Justice and Empowerment [MoSJE], 2019).

The SUD group included individuals meeting diagnostic criteria for substance use disorder as confirmed through clinical records and screening assessments. In contrast, the control group consisted of individuals with no current or past diagnosis of substance use disorder. Participants with a history of major neurological disorders, psychotic disorders, or intellectual disability were excluded from both groups.

The World Health Organization Alcohol, Smoking and Substance Involvement Screening Test (WHO-ASSIST) (World Health Organization, 2010), which screens for alcohol and other drug involvement and has good psychometric properties (intra-rater reliability =.84; test–retest ICC =.97), was used to measure the severity of substance use. The Difficulties in Emotion Regulation Scale (DERS) (Gratz & Roemer, 2004) is a 36-item test with good test-retest reliability (ρ_i =.88) that measures six aspects of emotion dysregulation. The Trail Making Test (TMT-A and TMT-B), which measures visual attention, processing speed, cognitive flexibility, and executive functioning, and exhibits strong test-retest and high inter-rater reliability, was used to assess cognitive performance. In addition, everyday cognitive difficulties related to attention, memory, and executive

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue III, March 2026

functioning were assessed using the Cognitive Assessment Questionnaire (CAQ), which demonstrates acceptable test–retest reliability (r=.71).

Statistical Analysis

The data was examined using IBM SPSS Statistics. Effect sizes were estimated using Cohen's d, independent samples, and descriptive statistics. To assess group differences between youths with SUD and controls, t-tests were employed.

MANCOVA was used to assess multivariate group differences in cognitive performance and emotion regulation after controlling for education level, age, and sleep patterns. Wilks' Lambda evaluated multivariate effects, followed by univariate analyses.

Ethical Considerations

The Institutional Ethics Committee's authorized ethical guidelines were followed for conducting the study. Prior to data collection, ethical approval was acquired. All participants provided written informed permission after being made aware of the study's objectives and methods; for those under the age of eighteen, assent was acquired in addition to approval from their legal guardians. All information was utilized only for research, and participant identities and confidentiality were rigorously upheld.

RESULTS

Table 1: **Demographic Characteristics and Substance Use Profile of Participants with SUD (N = 160)**

Variables/Attributes	N	%	M	Sd
State Of The Participants	160			
Assam	160			
Age Of Participants	160		24.5188	3.52524
Gender Of Participants	160			
Male	139	86.9		
Female	21	13.1		
Religion Of The Participants	160			
Hindu	140	87.5		
Muslim	19	11.9		
Christian	1	.6		
Ethnic Community	160			
Tribal	36	22.5		
Non-Tribal	124	77.5		
Place Of Residence	160			
Rural	55	34.4		
Urban	72	45.0		
Semi Urban	33	20.6		
Education Level	160			
No Formal Education	5	3.1		
Primary	55	34.4		
Secondary	66	41.3		
Graduate	31	19.4		
Postgraduate	3	1.9		
Family Structure	160			
Nuclear	127	79.4		
Joint	6	3.8		
Single Parent	16	10.0		

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue III, March 2026

Divorced Parents	11	6.9		
If There Is Any Person In The Family Who Uses Substances	160			
No History	12	7.5		
Grandfather	6	3.8		
Father	115	71.9		
Both Parents	7	4.4		
Siblings	7	4.4		
Spouse	13	8.1		
Peer Influence	160			
Yes	158	98.8		
No	2	1.3		
Cultural Practices Of Substance	160			
Yes	32	20.0		
No	128	80.0		
Yes	156	97.5		
No	4	2.5		

Note. N = number of participants; % = percentage; M = mean; SD = standard deviation. Data represent frequencies, percentages, and descriptive statistics of the demographic characteristics of participants diagnosed with Substance Use Disorder (SUD) from Assam

The demographics of young people in Assam with substance use disorder (SUD) are reported in Table 1, (N = 160). Participants had a mean age of 24.52 years (SD = 3.53) and were predominantly male (86.9%). Most identified as Hindu (87.5%) and belonged to non-tribal communities (77.5%). Nearly half resided in urban areas (45.0%), and the majority had completed primary or secondary education (75.7%).

Most participants lived in nuclear families (79.4%). A high prevalence of contextual risk factors was observed, with 92.5% reporting a family history of substance use most commonly involving the father (71.9%) and 98.8% reporting peer influence. In general, the group has a high-risk sociocultural profile with significant exposure to substance use from peers and family.

Table 2: Independent Samples t-Test Comparing Youths with Substance Use Disorder (SUD) and a Control Group on Substance Use Severity, Emotion Regulation, and Cognitive Functioning

Variable	SUD (M ± SD)	Control (M ± SD)	t(318)	p	Cohen's d
Total Alcohol	0.94 ± 1.13	0.49 ± 0.50	4.65	< .001	0.50
Total Sedative	1.83 ± 0.60	0.00 ± 0.00	38.52	< .001	4.31
Total Opioids/Heroin	2.72 ± 0.88	0.00 ± 0.00	39.21	< .001	4.38
Non-acceptance of Emotional Responses	26.22 ± 2.69	22.64 ± 2.83	11.57	< .001	1.30
Difficulty in Goal-Directed Behavior	19.15 ± 1.61	15.91 ± 1.83	16.80	< .001	1.88
Impulse Control Difficulties	23.06 ± 1.69	18.46 ± 1.70	24.23	< .001	2.72
Lack of Emotional Awareness	9.32 ± 2.44	9.44 ± 2.59	−0.42	.673	−0.05
Limited Access to ER Strategies	32.74 ± 4.57	25.12 ± 3.00	17.63	< .001	1.97
Lack of Emotional Clarity	16.81 ± 2.15	15.35 ± 2.54	5.54	< .001	0.62
DERS Total	127.29 ± 9.92	106.93 ± 8.48	19.73	< .001	2.20
TMT-A Time (sec)	1.64 ± 0.48	24.86 ± 3.85	−75.76	< .001	−8.42
TMT-A Errors	0.64 ± 0.90	0.06 ± 0.23	7.91	< .001	0.84
TMT-B Time (sec)	1.98 ± 0.16	69.98 ± 11.69	−73.59	< .001	−8.89
TMT-B Errors	1.40 ± 1.05	0.19 ± 0.60	12.65	< .001	1.37
B–A Time Difference	72.10 ± 12.09	45.13 ± 12.40	19.71	< .001	2.19
Forgetfulness	26.45 ± 1.73	6.19 ± 1.53	111.04	< .001	12.39
Distractibility	26.98 ± 1.91	6.38 ± 1.54	106.14	< .001	12.19

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue III, March 2026

False Triggering	24.85 ± 1.73	6.40 ± 1.19	111.32	< .001	12.44
CAQ Total Score	78.28 ± 3.79	18.98 ± 4.02	135.84	< .001	15.13

Note. Values are presented as *M* ± *SD*. SUD = Substance Use Disorder; ER = Emotion Regulation; DERS = Difficulties in Emotion Regulation Scale; TMT = Trail Making Test; CAQ = Cognitive Assessment Questionnaire. Cohen's *d* represents effect size, with values of 0.20, 0.50, and 0.80 indicating small, medium, and large effects, respectively. Negative *t* and *d* values indicate poorer performance in the SUD group relative to controls. All tests were two-tailed with *df* = 318.

Independent samples *t*-tests showed that youths with Substance Use Disorder (SUD) had significantly higher substance use severity (alcohol, sedatives, and opioids) than controls who were healthy without SUD, with medium to extremely large effect sizes (*ps* < .001). The SUD group also demonstrated significantly greater difficulties in emotion regulation across most DERS domains and on the DERS total score (*ps* < .001), except for lack of emotional awareness, which was not significant. In terms of cognitive functioning, youths with SUD showed marked impairments, including significantly poorer performance on the Trail Making Test (A and B), higher error rates, larger B–A time differences, and substantially higher cognitive complaints on the CAQ (all *ps* < .001), with very large effect sizes. Overall, the findings indicate pronounced deficits in emotion regulation and cognitive functioning among youths with SUD compared to controls.

Table 3: MANCOVA Results Examining Group Differences in Cognitive Functioning Between Youths with Substance Use Disorder and a Control Group

Effect / Dependent Variable	Wilks' Λ	F	df	p	Partial η^2
Multivariate Effects					
Age	.997	0.20	5, 311	.962	.003
Education	.991	0.58	5, 311	.718	.009
Sleep Patterns	.969	1.98	5, 311	.082	.031
Population Type (SUD vs Control)	.023	2657.69	5, 311	< .001	.977
Univariate Effects (Adjusted for Covariates)					
Trail Making Test–A (Time)	—	4470.41	1, 315	< .001	.934
Trail Making Test–A (Errors)	—	51.45	1, 315	< .001	.140
Trail Making Test–B (Time)	—	4297.24	1, 315	< .001	.932
Trail Making Test–B (Errors)	—	108.07	1, 315	< .001	.255
B–A Time Difference	—	301.63	1, 315	< .001	.489

Note. MANCOVA = Multivariate Analysis of Covariance. Covariates included age, education, and sleep patterns. Wilks' Lambda (Λ) is reported for multivariate effects. Partial eta squared (η^2p) indicates effect size, with values of .01, .06, and .14 representing small, medium, and large effects, respectively. Higher scores indicate poorer cognitive performance.

To investigate group differences in cognitive performance between young people with Substance Use Disorder (SUD) and healthy controls, a MANCOVA was performed, adjusting for age, education, and sleep patterns. The multivariate effects of age, education, and sleep patterns were not significant (*ps* > .05). In contrast, population type (SUD vs. control) showed a highly significant multivariate effect on cognitive functioning, Wilks' Λ = .023, $F(5, 311) = 2657.69$, $p < .001$, $\eta^2p = .977$, indicating an extremely large effect.

Follow-up univariate ANCOVAs revealed that youths with SUD performed significantly worse than controls on all cognitive measures, including TMT-A time and errors, TMT-B time and errors, and the B-A time difference (all *ps* < .001), with large to very large effect sizes (η^2p = .140-.934). Overall, the results demonstrate profound cognitive impairments among youths with SUD even after adjusting for relevant covariates.

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue III, March 2026

Table 4: MANCOVA Results Examining Group Differences in Emotion Regulation Between Youths With Substance Use Disorder (SUD) and a Control Group

Effect / Dependent Variable	Wilks' Λ	F	df	p	Partial η^2
Multivariate Effects					
Age	.982	0.93	6, 310	.472	.018
Education	.948	2.86	6, 310	.010	.052
Sleep Patterns	.982	0.95	6, 310	.463	.018
Population Type (SUD vs Control)	.319	110.07	6, 310	< .001	.681
Univariate Effects (Adjusted for Covariates)					
Non-acceptance of Emotional Responses	—	91.03	1, 315	< .001	.224
Difficulty in Goal-Directed Behavior	—	214.60	1, 315	< .001	.405
Impulse Control Difficulties	—	458.78	1, 315	< .001	.593
Lack of Emotional Awareness	—	0.33	1, 315	.565	.001
Limited Access to ER Strategies	—	255.57	1, 315	< .001	.448
Lack of Emotional Clarity	—	25.01	1, 315	< .001	.074
DERS Total	—	297.80	1, 315	< .001	.486

Note. MANCOVA = Multivariate Analysis of Covariance. Covariates included age, education, and sleep patterns. Wilks' Lambda (Λ) is reported for multivariate effects. Partial eta squared (η^2p) indicates effect size, with .01, .06, and .14 representing small, medium, and large effects, respectively. Higher scores indicate greater emotion regulation difficulties.

Another MANCOVA was conducted to examine group differences in emotion regulation between youths with Substance Use Disorder (SUD) and control who were healthy without SUD while controlling for age, education, and sleep patterns. At the multivariate level, education showed a significant effect, Wilks' $\Lambda = .948$, $F(6, 310) = 2.86$, $p = .010$, $\eta^2p = .052$, whereas age and sleep patterns were not significant (*ps* > .05). Population type demonstrated a highly significant multivariate effect on emotion regulation, Wilks' $\Lambda = .319$, $F(6, 310) = 110.07$, $p < .001$, $\eta^2p = .681$, indicating a very large effect. Follow-up univariate ANCOVAs indicated that youths with SUD reported significantly greater difficulties in non-acceptance of emotional responses, goal-directed behavior, impulse control, limited access to emotion regulation strategies, lack of emotional clarity, and overall emotion regulation (DERS total) compared to controls (all *ps* < .001), with medium to large effect sizes ($\eta^2p = .074$–$.593$). For the lack of emotional awareness, no significant group difference was found $F(1, 315) = 0.33$, $p = .565$, $\eta^2p = .001$. Overall, the findings indicate pronounced emotion regulation deficits among youths with SUD even after adjusting for key covariates.

DISCUSSION

The present study investigated cognitive impairments and emotion regulation difficulties among youths with Substance Use Disorder (SUD) in comparison to healthy controls, providing empirical evidence for substantial dysfunction across both domains. The results show that long-term drug abuse in young people is linked to significant deficits in executive functioning, alongside pervasive affective dysregulation, underscoring the intertwined nature of cognitive and emotional processes in substance use disorder.

The demographic characteristics of youths with SUD in the present sample further contextualize these findings. High levels of peer pressure and a family history of drug abuse are consistent with established evidence highlighting social and environmental pathways to substance involvement during adolescence and early adulthood (Hawkins et al., 1992; Kandel, 2002). National data from India similarly indicate substantial substance use among adolescents, underscoring the public health relevance of the present findings (Ray, 2004; Dhawan et al., 2025). Such contextual risk factors may interact with cognitive and emotional vulnerabilities, amplifying risk for substance use disorder.

Youths with SUD demonstrated marked impairments in cognitive functioning, including slower processing speed, reduced cognitive flexibility, higher error rates, and greater executive control costs on the Trail Making

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue III, March 2026

Test. These findings are consistent with evidence indicating that substance use disorders are associated with significant neurocognitive impairments, particularly in executive domains such as attention, working memory, and cognitive control (Bates et al., 2002). These deficiencies have significant ramifications for treatment engagement and functional outcomes, as impaired executive functioning may hinder decision-making, planning, and behavioral self-regulation.

Neurocognitive models of addiction emphasize that impaired decision-making and reduced inhibitory control are central features of substance use disorders (Bechara, 2005). Neuroimaging and neuropsychological evidence further suggests that dysfunction in prefrontal brain regions contributes to poor executive control and compulsive substance-seeking behaviors (Goldstein & Volkow, 2011). In the context of adolescence and young adulthood, substance exposure may be particularly detrimental, as this developmental period involves ongoing brain maturation and heightened vulnerability to neurocognitive disruption (Squeglia et al., 2009).

Consistent with prior reviews, Substance use-related cognitive deficits are not restricted to any one substance; rather, they are shown across a variety of drug classes, indicating a common neurocognitive susceptibility (Scott et al., 2007). The presence of elevated everyday cognitive complaints among youths with SUD in the present study further supports evidence that neurocognitive impairments extend beyond laboratory-based tasks can make it difficult to carry out regular task (Bates et al., 2002).

In addition to cognitive impairments, youths with SUD exhibited significant difficulties in emotion regulation, including greater non-acceptance of emotional responses, impaired goal-directed behavior under distress, impulse control difficulties, limited access to adaptive emotion regulation strategies, and reduced emotional clarity. These conclusions align with meta-analytic and theoretical literature identifying emotion dysregulation as a transdiagnostic feature across multiple forms of psychopathology, including substance use disorders (Aldao et al., 2010; Berking & Wupperman, 2012).

Emotion regulation deficits may increase reliance on substances as a maladaptive strategy for managing negative affective states. This explanation is in line with the self-medication hypothesis, which holds that when adaptive coping strategies are inadequate, people turn to drugs to reduce emotional pain (Khantzian, 1997). Deficits in behavioral regulation and decision-making are strongly associated with emotional dysregulation in SUD, as evidenced by difficulties with impulse control and goal-directed conduct (Bechara, 2005; Simons et al., 2009).

Notably, the lack of a substantial group disparity in emotional awareness raises the possibility that deficiencies in behavioural control and emotion regulation, rather than fundamental emotional detection, may be more severe in young people with SUD. This pattern is consistent with models emphasizing regulatory failure and impulsivity as key mechanisms underlying substance use behaviours (Bechara, 2005).

The holistic models of addiction that view substance use disorder as a condition involving disrupted neural systems governing reward processing, executive control, and emotional regulation are supported by the co-occurrence of executive dysfunction and emotion regulation difficulties seen in this study (Koob & Volkow, 2016; Volkow et al., 2016). Cognitive impairments may reduce the capacity to inhibit maladaptive impulses, while emotion dysregulation may heighten vulnerability to substance use during periods of emotional distress, together contributing to the persistence of substance use behaviors.

Implications

The findings of the present study underscore the need for intervention approaches that extend beyond substance cessation to address underlying cognitive impairments and emotion regulation difficulties among youths with Substance Use Disorder (SUD). Interventions focusing solely on abstinence may be insufficient if deficits in executive functioning and affective regulation remain unaddressed. Accordingly, evidence-based approaches that enhance self-regulation, impulse control, and adaptive coping strategies are likely to improve treatment outcomes (Berking & Wupperman, 2012). Preventive efforts should also account for family and peer influences, given their established role in shaping substance use behaviours (Hawkins et al., 1992; Kandel, 2002). Furthermore, early identification and screening of cognitive and emotional vulnerabilities in school and

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue III, March 2026

community settings may facilitate timely and targeted preventive interventions. Future research may build upon these findings by employing longitudinal designs to clarify causal pathways, incorporating more diverse and community-based samples to enhance generalizability, and integrating multi-method approaches, including behavioral and neurobiological assessments, to strengthen explanatory depth. Additionally, examining the role of psychiatric comorbidities and patterns of polysubstance use may provide a more comprehensive understanding of cognitive and emotional outcomes in this population.

Limitations of the Study

While the present study offers important insights, certain methodological considerations should be noted. The cross-sectional design limits causal interpretations, and the sample, being predominantly male and treatment-seeking, may restrict broader generalizability. These considerations do not undermine the robustness of the findings but indicate avenues for further research.

CONCLUSION

In conclusion, the current study offers evidence showing youths with substance use disorder exhibit significant cognitive impairments and dysregulated affect compared to healthy controls. Grounded in established theoretical and empirical literature, these findings highlight substance use disorder as a condition characterized by intertwined cognitive and emotional dysfunctions during a critical developmental period. Designing successful preventive and therapeutic methods for young people with drug use disorder requires addressing these processes.

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