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Evaluating and comparing neuropsychological strengths and areas of enhancement in individuals diagnosed with Alcohol Dependence Disorder and those considered normal.

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ABSTRACT

Alcohol Dependence Disorder (ADD) is a significant public health concern characterized by compulsive and uncontrolled alcohol consumption, resulting in physical, psychological, and social consequences. Neuropsychological impairments associated with ADD are crucial yet understudied aspects of the disorder. This study aims to investigate and compare the neuropsychological strengths and areas of enhancement in individuals diagnosed with ADD and normal controls. Employing a cross-sectional study design, the research will recruit individuals diagnosed with ADD and normal controls, administering a battery of neuropsychological assessments, including tests of attention, memory, executive function, and processing speed, in a controlled laboratory setting to ensure standardized conditions. The findings will shed light on the neuropsychological profiles of individuals with ADD compared to normal controls, crucial for developing targeted interventions to address cognitive deficits and improve overall well-being in individuals with alcohol dependence. Results showed significant differences between patients with alcohol dependence and normal subjects. Motor Scale: ADD group scored higher (mean = 89.80, SD = 21.67) than controls (mean = 72.60, SD = 9.23), $p < 0.01$. On Tactile Scale, ADD group scored higher (mean = 50.95, SD = 15.57) than controls (mean = 41.50, SD = 2.23), $p < 0.01$. On Visual Scale, ADD group scored higher (mean = 48.85, SD = 17.24) than controls (mean = 37.70, SD = 2.15), $p < 0.01$. No significant difference was found on the Expressive Speech Scale. These findings highlight neuropsychological deficits in individuals with ADD, suggesting a need for targeted cognitive interventions.

INTRODUCTION

Neuropsychology seeks to understand the relationship between the brain and behavior, that is, it attempts to explain the way in which the activity of the brain is expressed in observable behavior. Neuropsychology is the science of the relationship between brain function and behavior (Kolb, 2000). Neuropsychology has two branches: clinical and experimental. Clinical neuropsychology assesses brain-injured individuals to diagnose lesions and aid rehabilitation, focusing on intelligence, personality, and sensory-motor deficits. Experimental neuropsychology studies normal subjects to explore brain-behavior relationships. This distinction, though not absolute, categorizes the field's work.

Alcohol Dependence Syndrome

Alcohol is increasingly becoming a major global public health issue due to its associated problems at individual, familial, community, and societal levels. Studies indicate a rising prevalence of alcohol consumption worldwide, with increased intake observed across the general population.

College students often face harmful consequences due to alcohol consumption, including academic failure, injuries, and high-risk sexual behavior. Studies report that over 1,400 students aged 18-24 sustain unintentional alcohol-related injuries annually. (Hingson et al. 2002). About 18% of drivers aged 16-29 and approximately 2.5 million adolescents drive under alcohol influence. Starting alcohol consumption at a young age correlates with behaviors elevating the risk of both unintentional and intentional injuries.

Dependence Syndrome According to ICD-10

Dependence Syndrome

Dependence syndrome involves prioritizing substance use over other behaviors, with a strong desire to consume drugs, alcohol, or tobacco. Return to substance use after abstinence may lead to a quicker reappearance of syndrome features compared to non-dependent individuals.

Diagnostic guidelines

A definite diagnosis of dependence should usually be made only if three or more of the following have been present together at some time during the previous year:

(a) A strong desire or sense of compulsion to take the substance;

(b) Difficulties in controlling substance-taking behavior in terms of its onset, termination, or levels of use;

(c) A physiological withdrawal state when substance use has ceased or been reduced, as evidenced by: the characteristic withdrawal syndrome for the substance; or use of the same (or a closely related) substance with the intention of relieving or avoiding withdrawal symptoms;

(d) Evidence of tolerance, such that increased doses of the psychoactive substance are required in order to achieve effects originally produced by lower doses (clear examples of this are found in alcohol- and opiate-dependent individuals who may take daily doses sufficient to incapacitate or kill nontolerant users);

(e) Progressive neglect of alternative pleasures or interests because of psychoactive substance use, increased amount of time necessary to obtain or take the substance or to recover from its effects;

(f) Persisting with substance use despite clear evidence of overtly harmful consequences, such as harm to the liver through excessive drinking, depressive mood states consequent to periods of heavy substance use, or drug-related impairment of cognitive functioning; efforts should be made to determine that the user was actually, or could be expected to be, aware of the nature and extent of the harm.

Tolerance, dependence, and addiction are all manifestations of brain changes resulting from chronic substance abuse and involve different brain pathways than those subserving acute drug reinforcement. Acute drug reinforcement appears to share a final common dopaminergic pathway from the ventral tegmental area of the brain to the nucleus accumbens. These acute processes are relatively unimportant for pharmacotherapy of dependence and addiction; instead, the neurobiology of changes associated with chronic use forms the basis for rational pharmacotherapy. This translation of neurobiology into effective treatments has been most successful for opioids, with more limited success for alcohol, nicotine, and stimulant dependence. Opioid treatments such as methadone, levo-alpha-acetyl methadol (LAAM), buprenorphine, and naltrexone act on the same brain structures and processes as addictive opioids, but with protective or normalizing effects. This concept of normalization is critical for effective treatments and is illustrated in this chapter, with opioids as the primary example. As we understand the molecular biology of dependence more fully, normalization appears to be a process very similar

to learning and may involve similar changes in gene activation and neuronal long-term potentiation (LTP) and long-term depression (LTD) that appear to underlie learned behaviors and emotional states.

Neuropsychological aspect of Alcohol Dependence Syndrome

Alcohol abuse is associated with a clear and consistent pattern of general cognitive deficits, which resolve to some extent with protracted abstinence. A minority (10%) of alcoholics, however, will develop persistent memory impairment (Wernicke–Korsakoff syndrome). Frequent consumption of large quantities of alcohol rather than lifetime consumption poses the highest risk for cognitive deficits (Fals-Stewart et al., 1994). Cognitive impairment in alcoholics is considered along a continuum, with classic WKS symptoms at one end. Gradual deterioration of cognitive functioning (alcoholic encephalopathy) progresses to alcohol-related dementia (Vik et al., 2004).

Newly detoxified alcoholics exhibit relatively intact verbal and general intellectual abilities, but impaired nonverbal abilities. Deficits exist, however, in novel problem solving, abstract reasoning, and learning and recalling information. Deficits in perceptual–motor abilities, abstract reasoning, and nonverbal learning and memory can persist for months or years (Allen & Landis, 1998).

Long-term recovery likely is influenced by intervening factors such as age, premorbid functioning, neuromedical risks and psychiatric comorbidity (Bates et al., 2002).

Alcoholics have impairment in cognitive processing of emotional signals. Alcoholics are specifically impaired on emotional nonverbal behaviour information processing. They are slower to correctly identify an emotion (Foisy et al., 2007). Studies of recovering alcoholics found deficits in the recognition of emotional facial expressions (EFE) (Oscar-Berman et al., 1992; Philippot et al., 1999; Kornreich et al., 2003; Frigerio et al., 2002). More specifically, studies on the ability to decode emotional facial expressions have systematically revealed that alcoholics decode emotional facial expressions less accurately than normal controls (Oscar-Berman et al., 1992; Philippot et al., 1999; Kornreich et al., 2003; Frigerio et al., 2002) and, to a lesser degree, than opiate dependent patients (Kornreich et al., 2003). In addition, recovering alcoholics overestimate the intensity of emotional facial expression (Philippot et al., 1999; Kornreich et al., 2003). They also need a greater intensity of nonverbal signals to perceive an expression as being present (Frigerio et al., 2002), and they display different patterns of interpretation of emotion as compared to controls, with a specific bias towards perceiving expressions as hostile (Philippot et al., 1999; Frigerio et al., 2002; Townshend & Duka, 2003). Such difficulties in the ability to recognize the emotions felt by others may have an important impact on sociability. Concerning alcohol dependence specifically, it is well known that alcoholics are confronted with severe interpersonal problems in their daily functioning, which are partly mediated by emotional facial expression decoding deficits (Kornreich et al., 2002). Studying cross modal integrative processes has the potential to help to enhance the understanding of psychiatric pathologies (Campanella & Belin, 2007). Two recent studies showed that the cross modal processing of face–voice emotions, particularly for anger, is disrupted in alcoholics (Maurage et al., 2007; Maurage et al., 2008). The authors outlined that this deficit, particularly salient in frontal regions at about 150 ms after stimulus onset, is more obvious in cross modal than in unimodal conditions.

Studies of Neuropsychology Deficit in Alcohol Dependent Syndrome

In a study by Singh et al. (2008) on neuropsychological impairment in male alcoholics, thirty alcoholics and thirty non-alcoholics were assessed using the PGI Battery of Brain Dysfunction. Results showed significantly higher mean dysfunctional rating scores in the alcoholic group across all variables compared to the non-alcoholic group. Additionally, the alcoholic group performed poorly on memory and intelligence tests. The findings also indicated that longer durations of alcohol intake were associated with greater deterioration in cognitive functioning.

In a study by Nowakowska et al. (2008) on cognitive dysfunctions in patients with Alcohol Dependence, significant disturbances of working memory and executive functions were noted compared to healthy subjects, regardless of short-term or long-term abstinence. There were no significant differences between short-term and long-term abstinent patients, except for better results in non-perseverance errors for those with long-term abstinence. Longer duration of alcohol addiction correlated with worse performance on neuropsychological tests, while higher education levels improved performance. Depression intensity did not correlate with cognitive impairment levels in the tests.

In a study by Mann et al. (1999), 49 alcohol-dependent men with an average dependency duration of 11.4 years were investigated for neuropsychological deficits in an in-patient treatment unit. Using a test-retest design with a control group of 49 healthy males, the researchers administered various neuropsychological tests. Results indicated that chronic alcoholism affects cognitive functioning, particularly verbal memory. Alcohol-dependent men scored significantly lower than controls on five of twelve neuropsychological measures.

In a study by Noël et al. (2001), 20 alcohol-dependent subjects were assessed alongside 20 normal volunteers using neuropsychological tests and SPECT analysis of brain function. The patients, at the end of a detoxification program with an average of 18.8 days of withdrawal, exhibited neuropsychological and brain function issues compared to controls, particularly in behavioral inhibition and working memory functions. These findings correlated significantly with poorer functioning of frontal brain regions in alcohol-dependent subjects.

Cognitive functions most affected would therefore include executive functions (such as: problem solving, working memory), attention, and response inhibition/impulsivity. Neuropsychological studies have shown that cognitive functions associated with frontal lobe functioning are heavily impaired in alcoholics, providing support for this hypothesis (Lawrence et al 2009b; Loeber et al 2009). Reviews and neuroimaging studies have provided further evidence for alcohol-related damage to the frontal lobes with findings of structural abnormalities in this region, in addition to significant decreases in cerebral blood flow (Crews & Nixon 2009; Oscar-Berman et al 1997; Sullivan & Pfefferbaum 2005). Right hemisphere functions are more susceptible to the damaging effects of alcohol. Functions such as visual learning, visual memory, visuo-spatial and visuo-constructional abilities have been shown to be highly impaired in alcoholics (Beatty et al 2000; Dawson & Grant 2000; Fama et al 2004). Another neuroimaging study demonstrated significant white matter abnormalities within the right hemisphere of alcoholics which may arguably render right hemisphere-dependent neuropsychological functions more susceptible to damage (Harris et al 2008). Multiple cognitive functions including executive functions, attention, speed of processing, verbal/visual learning, verbal/visual memory, and visuo spatial functions appear to be impaired in alcoholism (Beatty et al 2000; Davies et al 2005; Harper & Matsumoto 2005; Noël et al 2007; Pitel et al 2009). Alcohol-related structural brain damage has also been detected in multiple brain regions including the cerebellum, limbic system, diencephalon, and the cerebral cortex (Harper & Matsumoto 2005; Oscar-Berman et al 1997). While structurally there appears to be support for generalized damage, from a cognitive perspective there is dispute on which cognitive functions are most affected by alcoholism. The degree of impairment in performance on neuropsychological tests differs across studies, with some showing selective susceptibility (Fein et al 2006; Uekermann et al 2003) and others showing widespread dysfunction (Davies et al 2005; Ratti et al 1999; Yohman et al 1985). Such findings suggest that some functions may be more vulnerable to the injurious effects of alcohol than others, insinuating that diffuse brain dysfunction may be too general of an assumption. Multiple cognitive functions that span many different regions of the brain have repeatedly been shown to be impaired in alcoholics. Executive functions, problem solving, attention, working memory, inhibition, impulsivity, speed of processing, learning, memory, and visuo spatial functions are all negatively affected by alcohol consumption (Davies et al 2005; Lawrence et al 2009a; Moriyama et al 2002; Noel et al 2001; Pitel et al 2007b). While the extent of impairment across many different cognitive functions remains in contention, most can agree that excessive and chronic consumption of alcohol induces significant disturbance to cognitive integrity. Also,

general consensus states that greatest cognitive dysfunction is presented during acute phases of abstinence (Oscar-Berman & Marinković 2007).

Alcohol Dependence and Normal Control Subjects:

Scheurich et al. (2004) demonstrated deficits of flexibility of closure and complex psychomotor coordination and Sullivan et al. (2002) found disturbances in gait and balance but relative sparing of upper-limb strength and speed at abstinence of 3.6 months. There was many explanations of subtle arithmetic dysfunctions in patients of alcohol dependence during abstinence period and one of most appropriate explanation may be subtle but persistent changes in attention and orientation as reported by Koskinen et al. (2011).

Xiao et al. (2015) Conducted the study on Regional gray matter deficits in alcohol dependence: A meta-analysis of voxel-based morphometry studies. Nine studies consisting of 296 alcohol dependent patients and 359 healthy controls were included in the present meta-analyses. Regional GM atrophy in alcohol dependent patients was found in the prefrontal cortex (including the anterior cingulate cortex), the dorsal striatum/insula, and the posterior cingulate cortex consistently across studies. The results remained largely unchanged in the following jackknife sensitivity analyses.

Welcome et al. (2014) conducted a study on cognitive functions and neuropsychological status of medical students with varying attitudes towards alcohol use at the Belarusian State Medical University, Minsk, Belarus. Seniors (3rd–6th year students) volunteered for the study. Out of 379 students invited, 95 did not participate, and 19 were excluded due to insincerity in a sincerity test. Statistical analysis included data from 265 student volunteers who scored ≥60% on the sincerity test, with 160 students completing attention tests. The average age was 22 years (19–30 years), with a final response rate of 69.9%. Findings revealed differences in cognitive functions, academic performance, functional and neuropsychological status, and anxiety levels between alcohol-consuming and abstaining students. Results suggested an inverse dose-dependent relationship between alcohol consumption and cognitive functions, academic performance, and neuropsychological status among medical students. In a study by Jang et al. (2007) on the relationship between brain morphometry and neuropsychological performance in alcohol dependence, twenty male patients diagnosed with alcohol dependence were selected from Severance Mental Health Hospital, Yonsei University College of Medicine. Twenty age-matched control subjects with no alcohol abuse history were included. Significant decreases in global gray and white matter were observed in alcohol dependence, with specific reductions in bilateral parahippocampal white matter areas. Correlations were found between decreased gray matter and perseverative responses/errors in the Wisconsin card sorting test, particularly in the left superior temporal gyri and right postcentral region. Psychological performance measures correlated with gray matter, while drinking amount correlated with right temporal white matter. This suggests that heavy alcohol consumption damages both gray and white matter, with gray matter atrophy primarily contributing to cognitive impairment and white matter associated with drinking history. In their study, Ferrett et al. (2010) investigated the neuropsychological performance of untreated adolescents with alcohol dependence in South Africa. They compared adolescents with "pure" alcohol dependence to light/non-drinking controls without comorbid psychopathology, matching them for various demographic factors. The research aimed to understand the cognitive functioning differences in adolescents with and without alcohol dependence, excluding those with comorbid disorders. English- and Afrikaans-speaking adolescents aged 13-15 from low socioeconomic backgrounds in Cape Town were recruited, excluding those with psychiatric, developmental, or other substance use disorders. Neuropsychological testing was conducted in participants' home language following detailed medical/psychiatric evaluation. The study found that adolescents with alcohol dependence performed more poorly on measures of Verbal Story Memory, Self-Monitoring, and Psychomotor Speed and Coordination when controlling for tobacco and other drug use as well as demographic variables.

OBJECTIVE OF THE STUDY

To evaluate and compare the neuropsychological deficits between patients with Alcohol Dependence Syndrome and normal control subjects.

STATEMENT OF THE PROBLEM

The investigation focuses on "A Comparative Study of Neuropsychological Deficits in Patients with Alcohol Dependence Syndrome and Normal Control Subjects."

HYPOTHESES OF THE STUDY

There will be no significant difference in neuropsychological deficits among patients with Alcohol Dependence Syndrome and Normal Control Subjects.

RESEARCH METHODOLOGY

VENUE OF THE STUDY: This study has been conducted at the Ranchi Institute of Neuro-Psychiatry and Allied Sciences (RINPAS) Kanke, Ranchi.
STUDY DESIGN: It was a hospital based cross sectional study among patients of Alcohol Dependence Syndrome and Normal Control Subjects.
SAMPLE SIZE: The sample is consisted of 40 participants, among which 20 patients of alcohol dependence syndrome and 20 normal control subjects.
SAMPLING METHOD: Participants have been selected by using the purposive sampling method.

INCLUSION AND EXCLUSION CRITERION:
Inclusion Criteria for Patients with Alcohol Dependence Syndrome.

- Diagnosed with alcohol dependence syndrome according to ICD-10 DCR.
- Male patients aged 20-45 years.
- Duration of illness of at least two years.
- Minimum education level of primary school and the ability to comprehend instructions.
- Provided informed consent.
- Right-handed.
- Cooperative behavior.

Exclusion Criteria for Patients with Alcohol Dependence Syndrome:

- History indicative of mental retardation.
- History indicative of head injury.
- Any significant physical illness.
- Presence of any comorbid psychiatric disorder.

Inclusion Criteria for Normal Control Subjects:

- No psychiatric diagnosis according to ICD-10 DCR.
- Male subjects aged 20-45 years.
- Minimum education level of primary school and the ability to comprehend instructions.
- Provided informed consent.
- Right-handed.
- Cooperative behavior.

Exclusion Criteria for Normal Control Subjects:

- History indicative of mental retardation.
- History indicative of head injury.
- Any significant physical illness.
- Presence of any comorbid psychiatric disorder.
- Age outside the range of 20-45 years.
- Uncooperative behavior.

TOOLS FOR ASSESSMENT

The following tools have been administered in the study

- ⇨ Socio- Demographic and Clinical Data Sheet (Self prepared).
- ⇨ Severity of Alcohol Dependence Questionnaire (SADQ-C).
- ⇨ AIIMS Comprehensive Neuropsychological Battery in Hindi (Adult Form).

DESCRIPTION OF THE TOOLS

⇨ **Socio- Demographic and Clinical Data Sheet**

This semi-structured Performa, tailored for the study, gathers socio-demographic details such as age, sex, marital status, education, occupation, domicile, and monthly family income of the subjects. Additionally, it captures information regarding diagnosis, illness course, duration, and history of significant head injury, seizure, mental retardation, and any other notable physical or psychiatric illness.

⇨ **Severity of Alcohol Dependence Questionnaire (SADQ-C)**

The Severity of Alcohol Dependence Questionnaire (SADQ-C) is a 20-item tool designed to gauge the severity of alcohol dependence (Stockwell et al., 1994). Widely utilized, it offers a quick and simple scoring process. Developed by the Addiction Research Unit at the Maudsley Hospital, it focuses on aspects of dependency syndrome including physical and affective withdrawal symptoms, relief drinking, frequency of alcohol consumption, and speed of onset of withdrawal symptoms. Each item is rated on a four-point scale: Almost never-0, Sometimes-1, Often-2, nearly always-3. A score of 31 or higher suggests severe alcohol dependence, 16-30 indicates moderate dependence, and below 16 typically denotes mild physical dependence.

⇨ **General Health Questionnaire-12 (GHQ-12)**

The General Health Questionnaire (GHQ), initially formulated by Goldberg and William (1988), is a self-administered test primarily used for screening purposes. GHQ-12, one of its versions, is sensitive to psychiatric disorder symptoms in primary health care and non-psychiatric clinical settings. It focuses on areas such as the ability to carry out normal activities and the presence of distressing experiences, making it valuable for ruling out psychopathology in healthy control subjects. GHQ-12's validity was found to be 0.78 (Baksheev et al., 2011), and reliability was determined as 0.90 (Hankins, 2008).

⇨ **AIIMS Comprehensive Neuropsychological Battery in Hindi (Adult Form)**

The AIIMS Comprehensive Neuropsychological Battery in Hindi, as introduced by Gupta et al. (2000), is a significant instrument for clinical and research purposes in neuropsychology. It effectively identifies and lateralizes brain dysfunction and offers an alternative to traditional clinical neuropsychological assessments. With its ability to measure a wide range of behaviors highly correlated with cerebral competence, it provides a valuable research tool for statistical analysis of brain-behavior relationships. The battery consists of 160 items in Hindi spread across 10 primary (basic) scales. Furthermore, it boasts a relatively short administration time of 2-3 hours.

Scale	Total	Items sequence of items
Motor scale	35	1 to 35
Tactile scale	19	36 to 54
Visual scale	8	55 to 62
Receptive speech	19	63 to 81
Expressive speech	17	82 to 98
Reading scale	10	99 to 107
Writing scale	13	108 to 121
Arithmetic scale	13	122 to 134
Memory scale	12	135 to 146
Intellectual process scale	14	147 to 160

From out of these basic content scales, the following three other scales are derived:

Scale	Total items	Sequence of items
Pathognomonic scale	7	17, 35, 38, 37, 41, 45, 160
Left Hemisphere scale	26	1, 3, 5, 7, 9, 11, 15, 17, 21, 37,
		45, 47, 49, 51, 53, 96, 97,
		127, 135, 139, 140, 148,
		150, 154, 155, 158.
Right Hemisphere scale	26	2, 4, 8, 10, 12, 14, 18, 20, 22,
		38, 46, 48, 50, 52, 54, 55, 57,
		61, 137, 138, 141, 144, 145,
		146, 160.

The AIIMS Comprehensive Neuropsychological Battery in Hindi is an extensive tool consisting of 14 clinical scales, comprising 10 primary and 4 secondary scales. Each item is rated on a 5-point scale ranging from 0 to 4, with higher scores indicating greater impairment. The battery demonstrates remarkable reliability, with test-retest reliability coefficients ranging from 0.792 to 0.984, indicating stability over time. Inter-rater reliability coefficients, ranging from 0.981 to 1.00, suggest minimal examiner variance. Moreover, internal-consistency reliability coefficients, ranging from 0.791 to 0.986, underscore the consistency of the battery's measurement. Additionally, the battery boasts well-documented construct and concurrent validity. Furthermore, 8 lobe (localizing) scales, including LF, LSM, LPO, LT, RF, RSM, RPO, and RT, facilitate the localization of neuropsychological dysfunctions.

PROCEDURE

In this study, 40 participants meeting inclusion and exclusion criteria were selected using purposive sampling. Among them, 20 patients with alcohol dependence were chosen based on their scores on the Severity of Alcohol Dependence Questionnaire. The remaining 20 participants were normal control subjects selected from various areas in Ranchi district, assessed using the GHQ-12 questionnaire. Detailed socio-demographic data were collected from all participants using a socio-demographic and clinical sheet. Subsequently, participants

underwent assessment using the AIIMS Comprehensive Neuropsychological Battery in Hindi (Adult Form) and a comprehensive test to evaluate different aspects of attention. All participants provided informed consent for the study.

STATISTICAL ANALYSIS:

The statistical analysis was done by help of the statistical package for social science-20 (SPSS-20). Mann Whitney U Test and Chi-square (χ^2) was used for the analysis of data.

Table 1: Socio-Demographic Details of Alcohol Dependent Disorder, and Normal Control Subjects:

Socio-Demographic Variables		Alcohol Dependents (N=20)	Normal Control Subjects (N = 20)	χ2	df
		n (%)	n (%)		
Education	Primary	3 (15.0)	2 (10.0)	3.65 NS	6
	Metric	7 (35.0)	6 (30.0)		
	Intermediate	7 (35.0)	5 (25.0)		
	Graduation & above	3 (15.0)	7 (35.0)		
Marital status	Single	3 (15.0)	9 (45.0)	4.28 NS	2
	Married	17 (85.0)	11 (55.0)		
Occupation	Employed	4 (20.0)	6 (30.0)	4.91 NS	4
	Unemployed	5 (25.0)	8 (40.0)		
	Self work	11 (55.0)	6 (30.0)		
Monthly Family Income	Low	11 (55.0)	10 (50.0)	0.99 NS	4
	Middle	6 (30.0)	7 (35.0)		
	Upper	3 (15.0)	3 (15.0)		
Domicile	Rural	13 (65.0)	7 (35.0)	7.17 NS	4
	Urban	4 (20.0)	8 (40.0)		
	Semi Urban	3 (15.0)	5 (25.0)		

NS (Not Significant)

Table-1 showing that the comparison of the socio-demographic profile of persons with alcohol dependence and normal control subjects. In the domain of education, No significant difference between alcohol-dependent and normal control subjects ($\chi2 = 3.65$, $p > 0.05$). In the domain of Marital Status, No significant difference between groups ($\chi2 = 4.28$, $p > 0.05$). In the domain of Occupation, No significant difference between groups ($\chi2 = 4.91$, $p > 0.05$). In the domain of Monthly Family Income, No significant difference between groups ($\chi2 = 0.99$, $p > 0.05$). In the domain of Domicile, No significant difference between groups ($\chi2 = 7.17$, $p > 0.05$).

Table 2: Shows age variable of persons with alcohol dependence and normal control subjects:

Socio-demographic Variables	Alcohol Dependents (N=20)		Normal Control Subjects (N = 20)		χ^2	df
	Mean ± SD	Mean Rank	Mean ± SD	Mean Rank		
Age (in years)	33.33 ± 5.21	30.60	32.90 ± 5.02	27.45	1.19 NS	2

NS (Not Significant)

Table -2 shows age range of patients with alcohol dependence was 20-45 years, mean = 33.33, standard deviation (SD) =5.21 and mean rank=30.60. Age range of normal control group was 20-45 years mean = 32.90, standard deviation = 5.02 and mean rank=27.45. The result of χ^2 value was found 1.19 indicates that there is no significant difference between persons with alcohol dependence and normal control subjects in terms of their age (χ^2=1.19, P>0.05).

Table 3: Showing course of illness variable of patients with alcohol dependent Disorder:

Socio-demographic Variables		Alcohol Dependents (N=20)	χ2	df
		n (%)		
Course of Illness	Continuous	14 (70.0)	0.44 NS	1
	Episodic	6 (30.0)		

The result shows that 70% patients with alcohol dependence group were from continuous course of illness and 30% patient with alcohol dependence were from episodic course of illness. No significant difference in the course of illness among alcohol-dependent patients (χ2 = 0.44, p > 0.05).

Table 4: Comparison of T scores of Clinical Scales of AIIMS Comprehensive Neuropsychological Battery between Patients of ADS and Normal Control Subjects:

CLINICAL SCALES	Alcohol Dependents (N=20)			Normal Control Subjects (N=20)			Mann-Whitney U	Z
	Mean ± SD	Mean Rank	Sum of Rank	Mean ± SD	Mean Rank	Sum of Rank		
T - Score (Motor Scale)	89.80 ± 21.67	25.48	509.50	72.60 ± 9.23	15.52	310.50	100.50	2.69**
T - Score (Tactile Scale) #	50.95 ± 15.57	23.65	473.00	41.50 ± 2.23	17.35	347.00	137.00	2.44**
T - **Score** (Visual Scale) #	48.85 ± 17.24	23.85	477.00	37.70 ± 2.15	17.15	343.00	133.00	2.38**
T - Score (Expressive Speech Scale)	71.60 ± 27.64	22.10	442.00	60.60 ± 14.76	18.90	378.00	168.00	0.88 NS
T – Score (Reading Scale) #	96.65 ± 37.37	25.28	505.50	66.60 ± 18.85	15.72	314.50	104.50	2.63**
T - Score (Writing Scale) #	67.95 ± 20.67	25.65	519.00	48.10 ± 14.01	15.05	301.00	91.00	3.09**
T - Score (Arithmetic Scale) #	69.50 ± 21.58	23.85	477.00	57.15 ± 10.90	17.15	343.00	133.00	1.81 NS
T - Score (Memory Scale)	56.60 ± 11.25	25.12	502.50	48.00 ± 9.28	15.88	317.50	107.50	2.50**
T - Score (Intellectual Process Scale)#	50.70 ± 12.99	24.15	483.00	42.40 ± 7.89	16.85	337.00	127.00	1.99*
T - Score (Total Battery)	602.60 ± 144.35	25.65	513.00	474.65 ± 53.15	15.35	307.00	97.00	2.78**

** Significant at the 0.05 level.*

*** Significant at the 0.01 level.*

NS – Not Significant

Table-4 shows that the comparison of mean, SD, mean rank and sum of rank score of all the clinical scale of AIIMS Comprehensive Neuropsychological Battery of persons with alcohol dependence and normal subjects.

To see the difference between patients with alcohol dependence and normal subjects group Mann Whitney U Test was calculated. Significant differences were found between alcohol-dependent and normal control subjects in Motor Scale, Tactile Scale, Visual Scale, Reading Scale, Writing Scale, Memory Scale, Intellectual Process Scale, and Total Battery ($p < 0.05$ or $p < 0.01$). No significant differences were found in Expressive Speech Scale and Arithmetic Scale ($p > 0.05$).

Table 5: Frequency of Abnormal Performance [i.e. T score > Expected T score] on the Clinical Scales of AIIMS Neuropsychological Battery among Schizophrenia, Alcohol Dependents, and Normal Subjects

Abnormal Performance [i.e. T score > Expected T score] on Clinical Scales	Alcohol Dependents (N = 20)	Normal Control Subjects (N = 20)	χ2 df=2
	n (%)	n (%)	
Motor Scale	14 (70)	3 (15)	19.79**
Tactile Scale	5 (25)	0 (0)	13.33**
Visual Scale	3(15)	0 (0)	0.122NS
Expressive Speech Scale	11 (55)	4 (20)	0.022*
Reading Scale	13 (65)	3 (15)	16.55**
Writing Scale	11 (55)	2 (10)	12.48**
Arithmetic Scale	11 (55)	4(20)	8.97*
Memory Scale	4 (20)	0 (0)	4.61NS
Intellectual Process Scale	8 (40)	2 (10)	9.23*

NS- Not Significant

Significant at 0.05 level

Significant at 0.01 level

Table 5 shows the frequency of abnormal performance on the clinical scales of AIIMS neuropsychological battery among alcohol dependent disorder and normal subjects. A significantly higher alcohol dependents patients have neuropsychological deficits found in most of the scales of AIIMS Neuropsychological Battery except Visual Scale and Memory Scale. Approximately one-third of alcohol-dependent subjects exhibited abnormal performance (T Score ≤ 40) across various clinical scales. The most frequently affected scales were Motor, Tactile, Memory, and Intellectual Process, with 30% of subjects showing abnormal performance. The analysis highlights significant neuropsychological deficits in alcohol-dependent subjects compared to normal controls, particularly in motor, tactile, visual, reading, writing, memory, and intellectual processing abilities.

Conclusion:

Significant neuropsychological deficits were observed in alcohol-dependent subjects compared to normal controls on several scales, including Motor, Tactile, Visual, Reading, Writing, Memory, Intellectual Process, and Total Battery scores. No significant differences were found in the Expressive Speech and Arithmetic scales, indicating these areas might be less affected by alcohol dependence. Approximately one-third of alcohol-dependent subjects demonstrated abnormal performance (T Score ≤ 40) on multiple neuropsychological scales, with the highest frequency observed in Motor, Tactile, Memory, and Intellectual Process scales. The findings suggest that individuals with Alcohol Dependence Syndrome exhibit significant neuropsychological impairments in several domains, particularly in motor skills, tactile and visual perception, memory, and intellectual processes. These deficits underline the need for comprehensive neuropsychological assessments in the treatment and rehabilitation of alcohol-dependent individuals. The research highlights the pervasive impact of alcohol

dependence on cognitive and motor functions, necessitating targeted interventions to address these impairments and support recovery.

Recommendations:

1. **Comprehensive Neuropsychological Assessments**: Implement routine neuropsychological assessments for individuals with Alcohol Dependence Syndrome to identify specific cognitive and motor deficits. This will help in tailoring individualized treatment plans.
2. **Targeted Interventions:** Develop and incorporate targeted cognitive rehabilitation programs that focus on areas significantly impaired in alcohol-dependent individuals, such as motor skills, tactile and visual perception, memory, and intellectual processes.
3. **Multidisciplinary Approach**: Adopt a multidisciplinary approach involving psychologists, neurologists, occupational therapists, and addiction specialists to provide comprehensive care that addresses both the psychological and physiological aspects of alcohol dependence.
4. **Preventive Strategies**: Educate individuals at risk of alcohol dependence about the potential neuropsychological impairments associated with prolonged alcohol use. Early intervention programs should be implemented to prevent the onset of these deficits.
5. **Longitudinal Studies**: Conduct longitudinal studies to monitor the progression of neuropsychological deficits in alcohol-dependent individuals over time and to evaluate the effectiveness of various intervention strategies.
6. **Support Systems**: Strengthen support systems, including counseling and support groups, to help individuals with alcohol dependence manage their condition and adhere to treatment plans.
7. **Policy Implementation**: Advocate for policy changes that mandate neuropsychological evaluations as part of the standard care for individuals diagnosed with Alcohol Dependence Syndrome. This can ensure that all patients receive comprehensive assessments and appropriate interventions.
8. **Training Programs:** Develop training programs for healthcare professionals to enhance their understanding of the neuropsychological impacts of alcohol dependence and to equip them with the skills needed to conduct effective assessments and interventions.
9. **Public Awareness Campaigns**: Launch public awareness campaigns to educate the general population about the cognitive and motor deficits associated with alcohol dependence, emphasizing the importance of seeking help early.
10. **Research Funding**: Increase funding for research focused on understanding the neuropsychological effects of alcohol dependence and developing innovative treatments to mitigate these effects.

By implementing these recommendations, healthcare providers can better address the neuropsychological challenges faced by individuals with Alcohol Dependence Syndrome, ultimately improving their quality of life and treatment outcomes.

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