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Original Research Article

A Hospital Based Cross-Sectional Study on Impairment of Executive Function in Alcohol Dependent Persons

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Abstract:

Background: One of the most commonly abused substances in the world is alcohol, which is also becoming more and more common in our nation and continues to be linked to a wide range of social, economic, and health issues. This study's objective was to evaluate the executive dysfunction of alcoholic dependent individuals to that of controls who were of a similar age.

Methods: In this single interview cross-sectional hospital-based investigation, 50 alcohol-dependent cases and 50 healthy relatives of the patients were included. The frontal assessment battery (FAB) was used to measure the executive function in all patients and the control group.

Results: When the results of the FAB were compared between the cases and the controls, it was discovered that the controls had a mean score of 16.96 and a standard deviation of 1.56, indicating better executive functioning, compared to the cases' mean score of 10.02 and a standard deviation of 2.64, which indicated more executive dysfunction.

Conclusion: Regular and prolonged alcohol use greatly reduces one's ability to use their executive functions.

Keywords: Alcohol dependence, Cognitive functions, Executive function, Frontal lobe functions, Neocortex.

Introduction

Alcohol has a hugely negative impact on society today. Over the past ten years, there has been an alarming increase in the number of people who drink. According to the World Health Organization (WHO), 208 million individuals worldwide (4.1% of the population over 15 years old) had alcoholism as of 2010. [1] Although there is little evidence to support a direct link between impairment and treatment response, studies show that chronic alcoholics have cognitive impairments, including a decline in their capacity to process new information, learn new skills, and plan strategies.

Theoretically, these impairments should undermine the behavioral changes targeted by treatment. The authors employed MATCH data (N = 1,726) and structural equation modeling to address this contradiction by matching alcoholism treatment to client heterogeneity. [2] Numerous methods have been used to measure the decline in neurocognitive function that happens in chronic drinkers. Loss of executive function has also been linked to episodic memory problems caused by chronic drinking. As a result, it was shown that evaluating executive dysfunction in chronic drinkers can assist us in understanding the severity of cognitive deterioration. The concept of executive functions is not exclusive. It involves a number of procedures that pertain to an individual's capacity to resolve challenging issues. According to one definition, executive functions consist of four parts: the capacity to set goals, plan how to reach those goals, carry out the plans, and perform effectively.

Despite any type of cognitive loss, a person with intact executive functions can carry on with an independent existence. [3] They are also thought to be able to anticipate how chronic alcoholics may fare. A person's ability to behave in a task-oriented manner is impeded by executive dysfunction. These results in behavioural disruptions that require goal activation and regulation of natural responses, both of which are crucial for responding to contextual changes and acting appropriately. [4] Consequently, clinical patients with executive dysfunction experience issues with impulsivity, hyperactivity, disorganized conduct, and aggression. Such patients may also experience some emotional dysregulation, which can eventually lead to mood disorders. [5] Numerous studies have shown that people with alcoholism are typically predisposed to progressive cognitive

decline, particularly in the executive functions. [6-8] since between 50 and 80% of patients with alcohol dependence exhibit poor cognitive function; addiction medicine professionals are paying more and more attention to cognitive deficits in alcohol-dependent patients without any other neurological issues. [9,10] To adjust patient management measures as best as possible, a thorough neuropsychological assessment or screening of these cognitive deficits appears to be essential. [11-13]

After the stage of detoxification is over, Adhikari et al. tested the executive function with FAB in 62 alcohol-dependent inpatients (N = 62), and they found that one-third of the study participants showed cognitive impairment. [14]

The effectiveness of management is significantly impacted by these cognitive deficits. Therefore, it is important to detect cognitive deficits brought on by drinking so that alcohol therapy can be tailored to their needs.

Material and Methods

This is a descriptive study of cognitive dysfunction in patients with alcohol dependence syndrome carried out in the Department of Psychiatry, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar from November 2022 to April 2023.

All patients who were admitted for alcohol detoxification were participated in the trial as soon as their benzodiazepine and gabapentin-based detoxifications were finished. Detoxification typically took place for two weeks. The International Classification of Disease and Related Health Problems (ICD-10) criteria (clinical descriptions for diagnostic guidance) were used to diagnose cases of alcohol dependence. [12]

Included in the study were patients who had been admitted and were over the age of 18 and had provided written informed permission. The study involved fifty participants. Purposive sampling was used to take the sample. All fifty participants met the inclusion and exclusion requirements and had a first-degree relative who was at least 18 years old. There was informed consent received. The study participants experienced no damage. Prior to cognitive evaluation, there was an average absence of two weeks. After 72 hours from the last dosage of benzodiazepine/gabapentin used for alcohol detoxification, cognitive evaluations were performed using the FAB and the Montreal Cognitive Assessment Test (MoCA). ICD-10 diagnostic criteria for alcohol dependency, abstinence for at least the previous three weeks, and no recent use of psychiatric medications were the inclusion criteria for a subject group. The study excluded participants with a history of using any other drugs, including tobacco, substantial head trauma, a neurological condition or seizure other than an alcohol withdrawal seizure, a history of a psychiatric condition, or mental retardation. Patients who were drunk, experiencing acute withdrawal, or in a delirious state were not included. Details of the cases' alcohol use revealed that the mean time spent in alcohol dependence was 3.97± 3.20 years, and the average weekly amount of alcohol used was 26 drinks. Majority of the participants used to drink alone and consumed Indian made foreign liquor.

The controls were the first-degree relatives of the alcohol dependency cases who were of similar age. More than two on the General Health Questionnaire was regarded as the cut-off limit for the control group. The exclusion criteria included having ever received a psychiatric condition diagnosis, misusing alcohol or any other drugs, having a clinically evident neurological issue, and having sustained a serious head injury. All patients' informed consent was first obtained after being informed of the study's goals and methods. To elicit the most data possible, the interview format was flexible. The confidentiality and privacy of the interviews were rigorously upheld in every case.

Graph Pad Prism for Windows version 6.01 was used to gather, tabulate, and perform statistical analysis on the pertinent data. The data were summarized using descriptive statistics. Where necessary, the unpaired t-test was used to determine the p-value and statistical significance. $P < 0.05$ was used to evaluate significance.

Results

This hospital-based study was done on 100 individuals, 50 of which were cases and 50 of which were controls. Table 1 shows the demographic variables of the cases and controls.

Table 1: Demographic variables of cases (n=50) and controls (n=50)

Age (in years)	**Cases n (%)**	**Controls n (%)**
<25	1(2%)	0(0%)
25-34	6(12%)	2(4%)
35-44	21(42%)	12(24%)
45-54	18(36%)	33(66%)
55-65	4(8%)	13(26%)
Religion	**Cases n (%)**	**Controls n (%)**
Christian	2(%)	1(2%)

Hindu	46(92%)	47(94%)
Muslim	2(4%)	2(4%)
Religion	**Cases n (%)**	**Controls n (%)**
Rural	35(70%)	41(72%)
Urban	15(30%)	9(18%)
Family	**Cases n (%)**	**Controls n (%)**
Joint	31(62%)	35(70%)
Nuclear	19(38%)	15(30%)
Marital status	**Cases n (%)**	**Controls n (%)**
Married	46(92%)	46(92%)
Separated	1(2%)	1(2%)
Single	3(6%)	3(6%)
Education	**Cases n (%)**	**Controls n (%)**
Graduate	3(6%)	2(4%)
Illiterate	6(12%)	7(14%)
Primary	34(68%)	32(64%)
Secondary	7(14%)	9(18%)
Occupation	**Cases n (%)**	**Controls n (%)**
Business	13(26%)	18(36%)
Daily laborer	5(10%)	9(18%)
Serviceman	23(46%)	9(18%)
Student	1(2%)	0(0%)
Unemployed	1(2%)	4(8%)
Unskilled	7(14%)	10(20%)
Socio-economic status	**Cases n (%)**	**Controls n (%)**
High	2(4%)	3(6%)
Low	6(12%)	16(32%)
Lower middle	24(48%)	11(22%)
Middle	15(30%)	20(40%)
Upper middle	3(6%)	0(0%)

The cases range in age from 25 to 65 years old, with a mean age of 57.5. The majority of cases (42% of all cases) were between the ages of 35 and 44.

These patients are predominantly Hindu (92%) and have a rural origin (70%). 92% of the cases were married, and 62% belonged to a combined family. Primary schooling made up the majority of instances (68%) followed by secondary education (14%), while service members made up the majority of cases (46%). Lower middle socioeconomic category (48%) and lower class (30%) made up the majority of the cases.

The length of alcohol consumption is shown in Table 2 for each case. With a mean of 13.5 years, the duration ranged from 1 to 25 years. Six to ten years accounted for the majority of instances (56%) and were followed by one to five years (36%).

Table 2: Duration of Alcohol intake of the cases (in years)

Duration in years	No. of patients	Percentage
1-5	18	36.00%
6-10	28	56.00%
11-15	1	2.00%
16-20	2	4.00%
21-25	1	2.00%

The controls' age ranged from 25 to 65, same like the cases, and the plurality (24%) of them belonged to the 35 to 44 age bracket. The majority of the cases (94% of them were Hindu), came from rural areas (72%), and belonged to mixed families (70%). Ninety two percent of them were married, and the majority (64%) had only completed kindergarten. The majority of the controls (36%) were businessmen with moderate socioeconomic status (40%). After applying the FAB to the cases and controls, we were able to determine the score needed to evaluate each case's executive dysfunction. The mean FAB scores for patients and controls are displayed in Table 2. The FAB had a mean score of 10.02± 2.64. The most severely compromised domain in FAB was lexical fluency, which was followed by mental flexibility and abstract reasoning. Environmental autonomy was

discovered to be rather well-preserved among the subjects. Most participants (62%) showed ordinary levels of executive function, while 38% reported executive function deficits.

Table 3: Comparison of the means scores of the cases and the controls

	Cases	Control
Total	501	900
Mean score	10.02	16.96
Standard deviation (±SD)	2.64	1.56
p-value	<0.0001	
Unpaired T-test score	21.3905	

When the results of the FAB were compared between the cases and the controls, it was discovered that the controls had a mean score of 16.96 and a standard deviation of 1.56, indicating better executive functioning, compared to the cases' mean score of 10.02 and a standard deviation of 2.64, which indicated more executive dysfunction. The difference between the groups was determined to be statistically significant using the unpaired t-test, with a p-value of <0.0001.

The comparison of the patients' and controls' mean Montreal Cognitive Test scores. On the Montreal Cognitive Test, the average case score was 23, whereas the average score for controls was 27. Delayed recollection, verbal fluency, visual/executive, and attentional domains were all impacted.

Discussion

The goal of this study was to ascertain whether a person's executive functions were impacted in any way by chronic alcoholism. In a hospital-based investigation, cognitive impairment and executive dysfunction in 50 alcohol-dependent individuals and 50 healthy controls were assessed. Based on the ICD-10 criteria for alcohol dependence, the patients were selected. [12] Abuse of alcohol causes brain abnormalities as well as related cognitive, emotional, and behavioural deficits.

The majority of patients in this study were found to be between the ages of 35 and 44 (42%) and 45 to 54 (36%), respectively. This was consistent with Singh et al.'s findings, according to which the majority of subjects (86%) belonged to the 36–45 age range. [13] Alcohol use lasted anywhere between 1 and 25 years, with a mean of 13.5± 8.54 years. The average length of alcohol dependence was 3.97±3.20 years, however it might last anywhere from 4 months to 12 years. The majority of study subjects (52.5%) exhibited moderate alcohol dependence, which was followed by severe (28%) and mild (19.5%) physical dependence. Similar results were found by Adhikari et al. in a research involving 62 alcohol-dependent people that were carried out at a tertiary hospital in Nepal. The Frontal Assessment battery's mean score for cases was 10.02 while it was 16.96 for controls, showing that the cases had poorer executive functioning than the controls did. In the alcohol-dependent patients, Adhikari et al. [14] from Nepal reported a score of 12.33± 2.46. International investigations carried out in New York also discovered that the executive functioning is worse the more alcohol is consumed.38% of patients with alcohol dependency showed impairment in 17 different executive function domains. The majority of the study participants had difficulties with memory, logical reasoning, problem-solving, and cognitive flexibility, which are all necessary for the multi-step activity of concept identification.

Similar to physical flexibility, mental flexibility points to issues with planning and the capacity to change and sustain a cognitive configuration. These results differed considerably in the tasks of abstract reasoning, memory discrimination, and timed tasks, and they were in line with the premise that alcohol dependence impairs concept identification. [19] The three FAB subtests, conceptualization, programming, and mental flexibility, which were more negatively impacted by long-term alcohol use, are discovered to be the tasks connected to the operation of various prefrontal cortical regions. [20] Jha et al. used the Wisconsin Card Sorting Test (WCST) to evaluate the conceptual ability of thirty alcohol-dependent subjects.

They then compared their results to those of thirty first-degree relatives and thirty normal controls, concluding that the conceptual ability of alcohol-dependent patients was lower than that of first-degree relatives or normal controls. In this study, alcohol addicts showed significantly diminished abstract reasoning, error usage, and compelling goal-directed behaviour. [21] Prior research examining the executive functions of newly abstinent alcoholics (i.e., those who had been sober for three weeks) found deficiencies in planning, abstraction, and the suppression of proponent reaction. [25,26] The MoCA exam was used in our study to assess cognitive abilities in alcohol-dependent patients. A 10-minute screening tool called the MoCA was evaluated by Copersino et al. [15] for its clinical usefulness, validity, and accuracy in detecting cognitive impairment in patients with substance use disorders. The reference criterion for calculating the MoCA's criterion-related validity and rates of correct and

incorrect classifications was the neuropsychological assessment battery's screening module. The MoCA's sensitivity (83.3%) and specificity (72.9%) for detecting cognitive impairment were acceptable. These findings suggest that the MoCA fills a key gap in the field of addiction treatment research by offering a time- and resource-conscious method for identifying patients with substance use disorders (SUDs) and cognitive impairment. Delay in recollection, verbal fluency, visuospatial/executive function, and attention are the four domains where we identified cognitive function impairment in alcoholics. According to Adhikari et al., who utilized the PGI memory scale on alcoholics, nearly half of the participants had problems with delayed recall, recognition, attention, and concentration. Researchers have found that the neocortex (particularly the frontal lobes), the limbic system, and the cerebellum are the parts of the brain that are most susceptible to the effects of alcoholism (reviewed by Moselhy et al. 2001). The most impacted areas of the brain are those involved in executive functioning and memory, including the frontal lobe, amygdala, hippocampus, and hypothalamus.

These results will assist the practitioner in recognizing that a subgroup of chronic alcohol patients may exhibit treatment difficulty because they do not understand the significance of the effects that counseling and therapy will have on their lives. Due to their inability to identify general principles and effective coping mechanisms on the relevant neuropsychological test, these patients are unable to appreciate the significance of concepts and events in their therapy. The results make it easier to realize how cognitively impaired alcoholic patients might not be able to fully understand the information given during therapy and, as a result, may not fully utilize the tactics provided, limiting their benefit from intervention.

Conclusion

According to our research, the majority of the alcohol-dependent subjects were young and Hindu. The longest period of alcohol consumption was determined to be between 6 and 10 years. We can also draw the conclusion that consistent and long-term alcohol consumption seriously inhibits executive functioning. Therefore, regular neuropsychological evaluation is crucial for the early identification and correction of underlying deficiencies, which completes the treatment of alcoholism.

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