



# A Comparative Analysis of Mental Capacity Functioning in Alcohol Dependence Syndrome and Cannabis

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## Abstract

**Background:** Executive functioning is a broad term referring to the set of higher-order cognitive processes that direct complex behaviors such as response inhibition, mental set shifting, abstraction, initiation, planning, problem solving, and cognitive flexibility. Deficits in executive functioning are paramount in MS, especially in patients with SPMS and PPMS and are attributed to prefrontal lobes functioning. Various researches have shown that individual with cannabis dependence syndrome may result in impaired executive functioning such as response inhibition, problems of attention, decision-making, problem solving, abstract reasoning and set shifting.

**Aim:** The present study has been undertaken with the aim to assess and compare the cognitive functioning deficits between the cases with cannabis dependence syndrome and normal control subjects.

**Methodology:** By using purposive sampling technique, 60 subjects diagnosed according to ICD-10 DCR criteria were selected for the present study. Further among these 60 subjects, 30 subjects were of alcohol dependence syndrome and 30 subjects were in the group of cannabis dependence syndrome. Tools used were Wisconsin Card Sorting Test, Alexander Pass-along test and Comprehensive Trail Making Test.

**Result and Conclusion:** The Results of the present study revealed that the subjects with alcohol dependence syndrome showed cognitive deficits when compared to cannabis control subjects. Subjects with cannabis dependence syndrome exhibited decreased level of attention, poor decision-making, mental capacity performance ability, inadequate problem solving and poor set shifting. Furthermore, it was also found that the subjects with cannabis dependence syndrome took more number of trails, more perseveration, high errors and extra time in comparison to normal control subjects on Wisconsin card sorting test, Pass-along test and Comprehensive Trail-making test.

**Keywords:** Cognitive Functioning; Problems of Attention; Decision-Making; Problem Solving Alcohol Dependence and Cannabis Dependence

**Abbreviations:** WCST: Wisconsin Card Sorting Test; CTMT: Comprehensive Trail-Making Test; APT: Alexander Pass along Test; CIIMHANS: Central India Institute of Mental Health and Neuro Sciences.

## Introduction

Executive functioning is a broad term referring to the set of higher-order cognitive processes that direct complex behaviors such as response inhibition, mental set shifting, abstraction, initiation, planning, problem solving, and cognitive flexibility. Deficits in executive functioning are paramount in MS, especially in patients with SPMS and PPMS [1,2] and are attributed to prefrontal lobe functioning [3]. Various researches have shown that individual with cannabis dependence syndrome may result in impaired executive functioning such as response inhibition, problems of attention, decision-making, problem solving, abstract reasoning and set shifting. The Wisconsin Card Sorting Test (WCST) [2] has become a gold standard in measuring executive functioning, tapping into set shifting, abstract 13 reasoning, and conceptual reasoning. Studies have found significantly fewer correct responses and more perseverative errors on the WCST in psychotic patients compared to healthy controls [4,5]. Alexander WP [6] Alexander Pass along Test measured intelligence of the participants. It consists of four wooden trays and wooden blocks, painted red or blue, with eight design cards. The subject is given a design card. They must make the image using the blocks. Each test has a time limit. The time taken to complete each card is scored to work out IQ. It was published by the Councils and Educational Press Limited. It was distributed by the National Foundation for Educational Research. The tests were used by the Institute of Education, University of Liverpool, between 1960 and 1990.

Wolwer W, et al. [7] conducted a study on the interaction of eye and hand movements a comprehensive index summarizing schizophrenia patients' difficulties during the performance process in Comprehensive Trail-Making Test (CTMT) was developed. The process of CTMT performance was modelled as a sequence of planning, acting and resting periods in 23 in patients with acute schizophrenia, 17 in patients with acute depression and 21 non-psychiatric controls, each assessed at least twice within four weeks. Transition probabilities between these states were calculated and structured by factor analysis. Throughout their hospital stay schizophrenia patients scored significantly lower than non-patients on a derived "visuo-manumotor integration factor", characterized by high loadings of transitions between planning and acting periods [8]. A significant negative correlation of this factor with performance time revealed frequent alternations between these two states and thus high factor scores to be a prerequisite for good CTMT performance.

## Methodology

### Aim

The present study has been undertaken with the aim to assess and compare the Mental Capacity Functioning between the cases with alcohol dependence syndrome and cannabis dependence syndrome.

### Hypotheses

The hypotheses of the study are as followed:

- There will be no significant difference in Executive functioning deficits in patients with alcohol dependence syndrome and cannabis dependence syndrome on Wisconsin Card Sorting Test.
- There will be no significant difference in Executive functioning deficits in patients with alcohol dependence syndrome and cannabis dependence syndrome on Alexander Pass along Test.
- There will be no significant difference in Executive functioning deficits in patients with alcohol dependence syndrome and cannabis dependence syndrome on Comprehensive Trail-Making Test.

### Venue

This study was conducted at Central India Institute of Mental Health and Neuro Sciences, Dewada, Rajnandgoan Chhattisgarh.

### Design

It was a hospital based cross sectional study.

### Sample

Present research is hospital based group design comprised of 60 participants. Out of which 30 patients were of alcohol dependence syndrome and cannabis dependence syndrome taken from CIIMHANS, Dewada, Rajnandgoan Chhattisgarh.

### Inclusion and Exclusion Criteria

**Inclusion criteria:** Patients diagnosed with typical cannabis dependence and alcohol dependence of all varieties described below F 10, the individual usually suffers from dependency of alcohol per ICD-10, age range minimum 18-50 years, gender only male, duration of illness at least one year. Educated at least primary level and are able to comprehend the instruction, Patient who will give consent for study, Patient who are cooperative and patient who are in remission.

**Exclusion criteria:** Uncooperative or unwilling to give consent, history of severe medical problem, patient age below 18 years or above 50 years and other psychotic, non-

psychosis (except psychosis & organic).

## Tools Used

The following tools were used for data collection:

- Wisconsin Card Sorting Test [1]
- Alexander Pass Along Test [6]
- Comprehensive Trail-Making Test [9]

## Procedure

In this study initially 60 participants who were meeting inclusion and exclusion criterion were selected for this study through purposive sampling. Out of these 60 participants 30 were having alcohol dependence and 30 were cannabis dependence syndrome. ADS and CDS patients were selected from the inpatient wards of Central India Institute of Mental Health and Neuro Sciences (CIIMHANS), Dewada, Rajnandgoan Chhattisgarh. AUDIT and CUDIT scales was administered on 80 patients and after screening it was found that 30 patients were able to meet the inclusion criterion for alcohol dependence and cannabis dependence, out of which 30 participants were selected finally for this study. After the selection of participants detailed socio demographic data was collected from all participants by using Socio-

demographic and clinical data sheet. Then the assessment of selected samples was done by using CTMT, Alexander pass along Test and WCST test.

## Statistical Analysis

The data was entered into the profile scoring sheet initially and thereafter was entered into statistic software (SPSS version 24). Descriptive, parametric and nonparametric tests were employed wherever appropriate. The socio-demographic and clinical characteristics of both groups of study i.e. Patients with Cannabis Dependence Syndrome and patients with Alcohol Dependence Syndrome. Distribution of participants of both group based on performance on various tests of executive functions used in the study viz. Comprehensive Trail Making Test (CTMT), Wisconsin Card Sorting Test (WCST), Alexander pass along test (APT) were compared using chi-square analysis to find out whether both group differed in performance on spearman correlation analysis was carried out to assess the nature of relationship of age, duration of illness and total level of level of attention, decision-making, mental capacity performance ability, inadequate problem solving and poor set shifting both the group of CDS and ADS with performance of participants on tests of executive functions of the study.

## Result Tables

WCST scores		ADS (N=30)		CDS (N=30)		$\chi^2$
		N	%	N	%	
WCST- Total number of errors	Good	0	0.00%	3	10.00%	24.33**
	Fair	1	3.30%	16	53.30%	
	Poor	29	96.70%	11	36.70%	
WCST- preservative responses Row score category	Good	2	6.70%	1	3.30%	1.75NS
	Fair	13	43.30%	18	60.00%	
	Poor	15	50.00%	11	36.70%	
WCST- preservative error Row score category	Good	0	0.00%	3	10.00%	3.16NS
	Fair	12	40.00%	11	36.70%	
	Poor	18	60.00%	16	53.30%	
WCST- Non preservative error Row score category	Good	4	13.30%	4	13.30%	9.02*
	Fair	13	43.30%	23	76.70%	
	Poor	13	43.30%	3	10.00%	
WCST- Trials to complete first category Row score category	Good	10	33.30%	7	23.30%	1.89NS
	Fair	4	13.30%	8	26.70%	
	Poor	16	53.30%	15	50.00%	

**Table 1:** Distribution of participants of both groups of the study according to level of scores obtained in various measures of WCST.

NS: Not Significant, \*\*  $p < .05$ - highly significant, \* Significant 0.05 level

Table 1, it is evident that the groups differed significantly on total number of errors and non-perseverative errors, with large proportion of participants of Alcohol Dependence Syndrome group showing significantly poorer performance in the above scores comparing with participants of the Cannabis Dependence Syndrome. The participants of both groups did not differ significantly in perseverative errors. Nearly half of patients with ADS and CDS (53% to 60%) of

both groups tend to make significant level of perseverative errors in WCST. The findings indicate that patients with ADS and CDS irrespective of having psychosis or not may show deficits in WCST. However large proportion of patients with Alcohol Dependence tends to perform poorer while comparing to that of patients having Cannabis Dependence groups.

APT - Performance IQ	Alcohol Dependence Syndrome (N=30)		Cannabis Dependence Syndrome (N=30)		$\chi^2$
	N	%	N	%	
<b>Below Average</b>	18	60.00%	12	40.00%	2.58 NS
<b>Borderline</b>	10	33.30%	16	53.30%	
<b>Mild Impairment</b>	2	6.70%	2	6.70%	

**Table 2:** Distribution of participants of both groups of the study according to level of performance IQ scores obtained in APT. NS: Not Significant

Table 2 shows distribution of participants of both groups of the study according to level of performance IQ scores obtained in APT. The result suggests that patients with ADS irrespective or not experiences deficits in intelligence, with greater proportion experiencing below average to borderline level of impairment. No significant difference in distribution of participants indicates that presence of comorbid seems to be not linked to level of intellectual functioning in patients with ADS.

Spearman correlation analysis was carried out to assess the nature of relationship of age, duration of illness and total level of psychiatric symptoms with performance of participants on tests of executive functions of the study. All participants of study i.e. those with CDS and ADS having and not having psychosis were combined together for the purpose of analysis.

CTMT Descriptive Rating	Alcohol Dependence Syndrome (N=30)		Cannabis Dependence Syndrome (N=30)		$\chi^2$
	N	%	N	%	
<b>No impairment</b>	0	0.00%	5	16.70%	17.55**
<b>Mild impairment</b>	0	0.00%	7	23.30%	
<b>Moderate impairment</b>	4	13.30%	6	20.00%	
<b>Severe impairment</b>	26	86.70%	12	40.00%	

**Table 3:** Distribution of participants of both groups of the study according to level of impairment in CTMT. \*\* p< .01- highly significant

Table 3 shows comparison of performance of participants having Alcohol Dependence Syndrome on CTMT. Results shows that both groups of participants showed impairment in CTMT, with significantly greater proportion of patients with alcohol dependence severely impaired compared to that of participants with cannabis dependence. 16.7% of participants in the CDS did not show any impairment whereas there was none in the ADS group.

Table 4 shows results of Spearman product moment correlation analysis between Age and scores obtained by participants on WCST, CTMT and APT. There was no significant correlation between age and scores obtained by participants on WCST, CTMT and APT which indicated that age was not related to performance in tests of executive functioning in patients with CDS and ADS.

Scores on tests of executive functions	Age
WCST- Total number of error row score	.026NS
WCST- preservative error Row score	.007NS
WCST- Non preservative error Row score	.106NS
WCST- conceptual level responses Row score	-.089NS
WCST- Number of categories completed Row score	-.021NS
WCST- Trials to complete first category Row score	-.173NS
CTMT Composite Index	.143NS
APT Performance Quotient	.073NS

**Table 4:** Results of correlation analysis between Age and scores obtained by participants on WCST, CTMT and APT. NS: Not Significant

## Discussion

It was found that the performance of dependent cannabis and alcohol users with differed significantly across various test scores assessed. On WCST no significant differences in perseverative responses and perseverative errors between cannabis and alcohol users on CTMT which assess the visuo-spatial scanning ability. The findings are consistent with results of study by Sholes and Iverson (2009) who in their research comparing cognitive functions between cannabis dependents with schizophrenia and those who did not had comorbid psychotic symptoms have found that there were significant differences in total number of errors and number of non-perseverative errors between the groups [10,11]. Further it was found nearly half of patients of both groups tend to make significant level of perseverative errors which indicated that 50 % patients with CDS and ADS irrespective of having psychotic symptoms or not tend to have impaired cognitive flexibility and likely to perseverate. In contrast to earlier anecdotal reports [12], a DSM-IV field trial [13] found that reintroduction of cannabis could relieve such symptoms only in 11% of individuals; although these lower rates could be due to the use of dependent and nondependent users. However, in a recent well-designed laboratory study, it was found that oral tetrahydro cannabinol and not divalproex reduced the symptoms of putative cannabis withdrawal [14]. The findings are consistent with Ruane J, et al. [15] who found that majority of long term cannabis users make large number of perseverative errors on card sorting. Sholes and Iverson (2009) have also found in their research that there was no were of impairment than participants without psychosis. 16.7% of participants showed intact visuo-spatial scanning whereas, all those participants having additional psychosis diagnosis had moderate to severe level of impairment in visuo-spatial scanning. Desai MS, et al. [16] in their research on cognitive functions of patients with cannabis dependence have found that most of the participants had shown deficits in trail making task, with patients who had psychosis showing significantly poorer performance comparing to those who

did not had any psychotic symptoms during the assessment [17].

All participants of the study had shown deficit in performance IQ with majority of participants scoring below average to borderline range. Mild level of impairment in IQ was seen only in two participants of both groups of the study. Findings indicated that presence or absence of CDS did not relate to performance in the IQ task. Pope HG, et al. [18] found that long-term cannabis users had a lower IQ. In the present study research shows result of Spearman product moment correlation analysis between Age and scores obtained by participants on WCST, CTMT and APT. There was no significant correlation between age and scores obtained participants on WCST, CTMT and APT which indicated that age was not related to performance in tests of executive functioning in patients with CDS and ADS. In most of research performance in test of executive functions was not found to be related to age of participants [19]. Similarly total duration of substance use was also not found to be related to performance of participants in the executive cognitive functions assessed in the study. The findings are consistent with that of Salowij, et al. (1992) who found that the age and duration of substance use were not related to impairment of cognitive functions in cannabis users. Participants who had more severe and multitude of symptoms tend to make more errors and complete less number of categories in WCST. They took more time to complete the visuo-spatial scanning tests of CTMT [20]. The findings indicated that severity of psychopathology is inversely related to executive functioning of individuals with Cannabis dependence syndrome and Alcohol Dependence Syndrome.

## Conclusion

Findings of this study suggest that cannabis dependence and alcohol dependence is associated with significant impairment in executive cognitive functioning. The impairment is not seen in all patients suffering from CDS and ADS. More

impaired test performance by patients who had comorbid Duration of age and Duration of CDS has more detrimental role in executive functions. These findings indicate towards the need of intervention as these cognitive impairments are manifested in day to day activity and leads to difficulty in the adjustment in different domains of life. Age and duration of substance seems to be not related to nature and extent of deficits in executive functions.

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