COGNITIVE FUNCTIONS IN ABSTINENT ALCOHOL DEPENDENT MALES – A CROSS SECTIONAL STUDY

Dissertation submitted to the

TAMIL NADU DR. M. G. R. MEDICAL UNIVERSITY

in part fulfillment of the requirements for

M. D (PSYCHIATRY)

BRANCH XVIII

APRIL 2013

MADRAS MEDICAL COLLEGE

CERTIFICATE

This is to certify that the dissertation title, **"Cognitive Functions In Abstinent Alcohol Dependent Males – A Cross Sectional Study "** submitted by **Dr.V.Sujaritha**, in partial fulfillment for the award of the MD degree in Psychiatry by The Tamil Nadu Dr.M.G.R. Medical University, Chennai, is a bonafide record of the work done by her in the Institute of Mental Health, Rajiv Gandhi Government General Hospital and Medical College during the academic years 2010-2013.

DIRECTOR

Institute of Mental Health

Chennai

DEAN

Rajiv Gandhi Government General Hospital and Medical College

DECLARATION

I, **Dr.V.Sujaritha,** solemnly declare that the dissertation titled , **“ Cognitive Functions In Abstinent Alcohol Dependent Males – A Cross Sectional Study ”** has been prepared by me under the guidance of Professor **Dr. Jeyaprakash, M.D., D.P.M.,** Director, Institute of Mental Health, Chennai. I also declare that this bonafide work or a part of this work was not submitted by me or any other for any award, degree, diploma to any other University board either in India or abroad.

This is submitted to The Tamilnadu Dr. M. G. R. Medical University, Chennai in partial fulfillment of the rules and regulation for the award of M.D degree **Branch – XVIII (Psychiatry)** to be held in April 2013.

Place : Chennai **Dr. V.Sujaritha**

Date :

ACKNOWLEDGEMENTS

I thank Prof. **Dr. Kanagasabai M. D.,** Dean, Rajiv Gandhi Government General Hospital and Medical College for permitting me to conduct this study.

I thank Professor **Dr. Jeyaprakash, M.D., D.P.M.,** Director, Institute of Mental Health, Chennai for his encouragement, help and guidance.

I thank Professor **Dr. V.S.Krishnan, M.D.,** Deputy Superintendent, Institute of Mental Health for her valuable guidance and help.

I thank my Guide, **Dr. M. Malaiappan, M.D.,** Associate Professor, Institute of Mental Health for his guidance and help.

My special thanks to **Dr. Poornachandrika, Dr. Sujatha** Assistant Professors, Institute of Mental Health for their guidance and suggestions.

My sincere thanks are due to all the Professors and Assistant Professors of Institute of Mental Health for their encouragement and support.

My sincere thanks to **Mrs. Shanthi,** Clinical Psychologist, Institute of Mental Health for her valuable help.

I finally acknowledge and thank all my colleagues and the participants of this study for their kind cooperation.

CONTENTS

INTRODUCTION

Humans have drunk alcohol for atleast 12000 years and it was being used in religious rituals in ancient cultures. Alcohol is an organic compound in which the functional hydroxyl group is attached to a carbon atom. Ethanol is the type of alcohol found in alcoholic beverages and its chemical formula is CH3-CH2-OH.

The lifetime risk for alcohol use disorders is more than 15% for men and between 8% and 10% for women, making alcoholism among the most common psychiatric conditions observed in the western world. In India, the estimated number of alcohol users in 2005 was 62.5 million, with 17.4% of them being dependent users. (Ray R, national survey on extent, pattern and trends of drug abuse in India, 2005)

The deleterious effects of alcohol on cognitive functioning were reported as early as the 1880s separately by wernicke and by korsakoff, followed by Hamilton, fisher and weschler. It was after the introduction of clinical neuropsychological model by Fitzhugh and co- workers on cognitive function in alcoholism which marked the beginning of systematic research in this area.

(Fein G, Bachman L, Fisher S, et al, 1990)

Wide research has been done in clinically evident cognitive impairments like those seen in korsakoff syndrome occurring due to thiamine deficiency. But there are no large scale epidemiologic studies to establish the prevalence of cognitive impairment in abstinent alcoholics which is not evident during routine interviews.

The rate of abstinent alcoholics with cognitive impairments has been reported in myriad studies. Most of the samples chosen for these studies where from inpatient or out-patient treatment settings and had used convenient samples.

(Fein G, Bachman L, Fisher S, et al, 1990)

Although studies show that cognitive deficits are reversible after prolonged abstinence, residual deficits do exist for some patients.

Although cognitive deficits are reversible during sustained abstinence, residual deficits persist in some patients for extended periods of time. Because of the patient's cognitive deficits, they find it difficult to continue their treatment and participate in treatment and also indulge effectively in their life. Assessing these functions as clinicians becomes essential as it helaps us choose appropriate treatment and to time the treatment. With this note it is also important to understand that not all alcoholics develop cognitive impairment.

As a result it eventually instilled a need for determining cognitive functions in alcohol dependent subjects during their abstinent period for better treatment outcome and to choose appropriate treatment in them.

Hence this study is conducted among alcohol dependent males during their abstinence period to assess their cognitive functions and to find the correlation between duration of abstinence and cognitive functions.

REVIEW OF LITERATURE

Cognition:

"Cognition is what enables humans to function in everyday life: personal, social and occupational. The ability to attend to things in a selective and focused way, to concentrate over a period of time, to learn new information and skills, to plan, determine strategies for actions and execute them, to comprehend language and use verbal skills for communication and self expression, to retain information and manipulate it to solve complex problems are examples of mental processes that are referred to as cognitive functions".

(Dalal et al, 2010)

"Cognitive deficits may result in the inability to:

1. Pay attention

2. Process information quickly,

3. Remember and recall information,

4. Respond to information quickly,

5. Think critically, plan, organise and solve problems,

6. Initiate speech"

(Dalal et al, 2010)

“Cognitive domains:

1. Working memory

Working memory (WM) function is thought to be sustained by a network of temporary memory systems. It plays a crucial role in many cognitive tasks, such as reasoning, learning and understanding. It refers to the ability to hold the stimuli ‘online’ for a short time, then either use it directly after a short delay or process or manipulate it mentally to solve cognitive and behavioural tasks. WM involves active rehearsing, processing and manipulation of information. WM seems to depend on the function of the prefrontal cortex (Goldman-Rakic PS, 1994)

2. Executive function

Executive function (EF) refers to the ability to use abstract concepts, to form an appropriate problem- solving test for the attainment of future goals, to plan one’s actions, to work out strategies for problem- solving, and to execute these with the self - monitoring of one’s mental and physical processes. Executive skills are most important in delaying with novel or complex situations. Physiologically, EF is linked to the cortical - subcortical circuits and frontal lobes (Cummings JL, 1993)

3. Attention and information processing

Attention refers to the ability to identify relevant stimuli, focus on these stimuli rather than others (selective attention), ability to perform a task in the presence of distracting stimuli (focused attention), sustain focus on the stimulus until it is processed (sustained attention or vigilance), and allow for the transfer of the stimulus to the higher –level processes (Trivedi, 2006)"

Alcohol dependence and cognitive deficits

Alcohol use disorders are characterised by the excessive consumption of alcohol despite its interference with individual's physical, mental, interpersonal, and social wellbeing. These effects are mediated through the brain, which undergoes changes in structure, function and basic physiology. (Margaret J.Rosenbloom and Adolf Pfefferbaum, 2008)

Cognitive deficits are common in alcohol dependence (Parsons, 1977) and may arise through direct toxic effects of alcohol or withdrawal, associated deficiency of vitamins such as thiamine or due to cirrhosis of the liver. The common cognitive deficit reported are deficits in problem solving, verbal and non verbal abstraction, visuo - motor coordination, learning and memory. (Tarter and Edwards, 1985; Parsons, 1998). These

findings are also supported by studies done by Noel et al 2001; Ratti et al 2002 which reports impaired abstract thinking, cognitive flexibility and persistence, inhibition of competing response in patients after use of heavy alcohol consumption. (S.J.C. Davies et al, 2005)

To support these findings there are various neuropsychological and neuroimaging studies which supports the notion that substance dependence is associated with dysfunctional neural circuits among which the prefrontal cortex is a key component. Poorer performances on tests of working memory and cognitive flexibility in users of alcohol have been linked to the functioning of the dorsolateral prefrontal cortex. (Errico et al, 2002)

(A.Verdigo- Garcia et al,2005)

Structural and physiological changes in relevant brain areas in chronic alcohol users add to the evidence that executive dysfunction is a characteristic sequela of chronic heavy drinking. It was demonstrated that chronic alcohol use causes atrophy of the frontal lobes by Kril et al, 1997 and Kubota et al, 2001. Studies also denote hypometabolism in the frontal cortex, which is associated with specific neuropsychological deficits. (Adams et al, 1993; Dao-Castellana et al, 1998; Demir et al,2002)

Evidence of structural and functional alterations in brain in chronic users

There are certain areas in brain which are immune from the ill effects of alcoholism. The regions of brain which are at risk include: prefrontal cortex, subjacent white matter, cerebellar site and white matter structure and tracts including the carpous callosum.

The results of MRI studies that compare patients with chronic alcoholism to people without a history of excessive alcohol use typically find:

1. Smaller volumes of gray matter in the cerebral cortex, the folded outer layer of the brain.
   (Cardenas et al. 2005; Chanraud et al. 2007; Fein et al. 2002; Gazdzinski et al. 2005*b*; Jernigan et al. 1991; Pfefferbaum et al. 1992)
2. Smaller volume of white matter lying beneath and beside cortical gray matter in alcoholics than in nonalcoholics.
   (Chanraud et al. 2007; Gazdzinski et al. 2005*b*; Pfefferbaum et al. 1992).
3. Older alcoholics show greater gray and white matter volume deficits when compared with the age-matched control subjects than younger alcoholics, especially in the frontal lobes even if the consumption of alcohol is in equivalent amount as younger alcoholics. This indicates

that as people age their brain becomes more vulnerable to the effects of excess alcohol consumption.

(Cardenas et al. 2005; Pfefferbaum et al. 1997, 1992)

Diffuse tensor imaging studies:

1.Reports of abnormally low anisotropy in regions of the corpus callosum as well as in a white matter region above the cerebellum (centrum semiovale) in both alcoholic men and women have occurred.

(Pfefferbaum et al. 2000 ,Pfefferbaum and Sullivan 2002).

2. DTI studies of corpus callosal microstructure by Pfefferbaum et al. 2006*b* found that an index of white matter tissue compromise (i.e., diffusivity) was strikingly higher in alcoholic men and women than in control subjects and showed regionally nonspecific, substantial correlations with macrostructural volume.

3.Studies using quantitative tractography shows signs of fiber tract degradation, particularly of myelin, in frontal and superior brain regions of alcoholics relative to controls (Pfefferbaum et al.)

There are only few studies to demonstrate the localised deficits in the brain for the multiple behavioural deficits occurring in alcohol dependence.

(Chanraud et al. 2007).

This difficulty in finding associations between alcohol related deficits in specific brain structures and specific cognitive functions has led to the hypothesis that the mechanism underlying alcohol related cognitive impairment may arise from the degradation of selective neural circuitry connecting cortical sites rather than either specific damage at the site or complete disconnection of white matter tracts connecting the cortical sites (Sullivan and Pfefferbaum 2005).

Invitro culture models has suggested that chronic use of alcohol causes inhibition of NMDA receptors and NMDA supersensitivity occurs during withdrawal. And neurotoxicity occurs through NMDA receptors.

(Chandler et al, 1993a, 1993b)

Human studies have shown that the best indicators of brain damage are recency and frequency of heavy drinking. These human studies also support neurodegeneration during intoxication.

(Sullivan and Pfefferbaum, 2005)

At the cellular level alcohol induced brain damage is related to oxidative stress from proinflammatory enzymes which are activated during ethanol intoxication.

CREB, cAMP responsive element binding protein and NF-kB, nuclear factor kB are transcription factors which regulate the gene expression.

CREB promote neuronal survival protecting neurons from excitotoxicity and apoptosis and act as pro survival factors. NF-kB plays a role in inflammatory and immune responses. In the presence of alcohol, there is increased DNA binding of NF-Kb and decreased binding of CREB. The imbalance between these transcription factors is a suggested mechanism for ethanol induced brain damage.

(Lonze and Ginty, 2002; Mantamadiotis et al., 2002; O'Neill and Kaltschmidt, 1997)

Another possible mechanism proposed is inhibition of ongoing genesis by alcohol. As a result there is loss of brain / tissue volume or neurodegeneration.

(Crews and Nixon, 2008)

In the study on binge model of alcohol dependence by Crews and Nixon, 2008 it has been found that even with one day of abstinence there is increased cell proliferation in multiple brain regions. Majority of the proliferating cells are the microglias. Another possible mechanism that contributes to increased cell growth during abstinence is the response to cell death, degeneration stimulated regeneration.

Another possible mechanism of regeneration during abstinence may be an increase in pCREB transcription as it rebounds from prolonged suppression, which increases plasticity and survival of neurons.

(Crews and Nixon,2008; Walton and Dragunow, 2000; Mabuchi et al., 2001; Hara et al., 2003).

Cognitive functions during abstinence

Nearly 45% of alcohol dependent individuals have residual cognitive deficits on neuropsychological testing after 3weeks of abstinence and about 15% retain deficits after 1year of abstinence.

(Rourke and Loberg, 1996).

The most significant factor which determines the presence of cognitive deficits in recovering alcoholics is the duration of abstinence.When this time period is controlled for, different patterns of deficits emerge. Three time periods have been described based on the duration of abstinence:

(George Fein et al, 1990)

1. **Cognitive impairment during Acute Detoxification period**

It is defined as the duration within 2 weeks of abstinence.

There has been a well-documented deleterious effect of alcohol on attention, concentration, reaction time, motor coordination, and motor speed, and judgment, problem-solving, learning, and short-term memory.

(Allen et al, 1971; Weingartner H et al, 1971; Page RD et al 1974; Clarke J et al,1975; Tarter RE et al,1971; Farmer RH et al,1973; long JA et al, 1974)

But this wide range of impairments improves substantially with detoxification. It is the residual deficits following detoxification that helps to plan treatment.

(George Fein et al, 1990)

2. Cognitive impairment during Intermediate-term

It is defined as the duration from 2weeks of abstinence to 2 months of abstinence. After detoxification, the overall composite IQ measured in abstinent alcoholics to test the intellectual functioning, falls within the normal range. The composite IQ is a measure of both crystallized and fluid intelligence. The crystallized intelligence is a measure of learned verbal skills and the fluid intelligence is a measure of visuospatial and problem solving skills.

After the detoxification the crystallized intelligence is intact clinically and it is the fluid intelligence skills which gets impaired. During a clinical interview in such patients because of the intact crystallized intelligence no apparent impairment is noted and it gives a mistaken impression that

patients' cognitive function are intact as the medical interview tests only the crystallized intelligence and not fluid intelligence.

(George Fein et al,1990)

This impairment in fluid intelligence i.e the visuo spatial processing and problem solving skills has been demonstrated in various studies during the intermediate abstinence period in recovering alcoholics as evidenced by lower performance IQ test scores compared to verbal IQ scores.

(Fitzhugh LC et al, 1965; Loberg T et al 1980; Loberg T et al, 1986; Klienknecht RA, 1972)

Recovering alcoholics also show impairments in other visuospatial and constructional tasks which needs motor speed, motor coordination and visual scanning and in copying complex design.

(Fitzhugh LC et al,1960; Loberg T et al,1980; Parsons OA, Leber WR, 198 1; Bergman H, Agren G, 1974;Grant I,1987; Sugerman A, Schneider D,1976; Bertera JH 1978)

The poor performance on complex visuospatial and constructional tasks reflect impairments in higher cognitive functions of perceptual analysis and synthesis, in patients with intact visusensory perception (Ryan C, Butters N,1983; Tarter RE,1975; Wilkinson DA, Carlen PL,1980)

The presence of motor deficits can influence and reduce the performance of visuomotor abilities. Tarter and Jones concluded after examining the motor

functioning of abstinent alcoholics two and eight weeks after detoxification that motor functioning becomes impaired after chronic alcohol abuse and shorter the period of abuse the greater is the possibility for recovery of motor deficits with abstinence.(Tarter RE, Jones B, 1971)

The outcome of this study implies that impaired motor functioning can influence the neuropsychological test which requires motor component and these deficits occur only in patients with long histories of alcohol abuse and that the possibility of impaired visuomotor ability in intermediate period of abstinence should be thought about in background of long history of alcohol consumption.

The other tests in which the abstinent alcoholics perform poorly compared to control group are on tests of problem-solving and abstracting abilities which includes development of hypothesis, strategies for problem solving, feedback monitoring and correction. Few studies in which tests used involved familiar and overlearned concepts have failed to show any deficits in verbal abstract reasoning.

(Fitzhugh LC, Fitzhugh KB, Reitan RM,1965)

When more challenging tests of verbal analogical reasoning are used, abstinent alcoholics do perform substantially more poorly than controls.

(Jonsson C ,1962; Yohman JR, 1987)

There are large number of studies to establish the above finding and indicates that about 75 % of intermediate term abstinent alcoholics perform in the impaired range on categorie subtest of halstead - reitan battery test. (Loberg T et al,1980; Long JA et al, 1974; Loberg T et al, 1986; Klienknecht RA et al, 1972; Parson OA, 1981; Grandt et al, 1985; Jones et al, 1971, 1971; Svanum 1986)

The majority of alcohol dependent population during their intermediate abstinence also evidences deficits in complex spatial problem-solving task and in tests that involves cognitive flexibility.

(Chelun et al, 1981)

Studies on learning and memory have not reported much deficits in these functions.Tarter and Edwards report that learning and memory deficits were elicited when patients were given challenging tasks and not during the standard clinical tests.

(Tarter et al, 1985)

There are studies which have reported short-term-memory impairments and learning deficits in both verbal and nonverbal tasks in these patients.

(Ryan et al,1980; Becker et al,1980; Brandt et al,1983; Cutting et al,1978 Ron et al,1980)

There are also studies which establish that short term memory tasks improves relative to the length of abstinence.(Allen et al, 1971; Weingartner, 1971)

It has been found that rather than using semantic strategies on verbal learning tasks, alcoholic patients tend to use rote learning, which is a far less efficient method. Butters and Brandt have also shown retrograde memory impairments in alcoholism. It has to be noted that the impairments in memory are not as conspicuous as are those in visuo-spatial, abstraction, and problem solving abilities.

Ellenberg et al in 1970 compared rates of recovery of verbal versus visuospatial learning abilities during alcohol abstinence and found that visuospatial learning abilities were found to recover more slowly.

The verbal learning ability which is impaired during the detoxification period, has been shown both to recover within the first two weeks of abstinence and impaired after a month.

(Weingartner, 1971; Ryan et al,1980; Sharp et al,1977).

Weingartner and colleagues in 1971 found that abstinent alcoholics were equivalent to non-alcoholic controls in their ability to remember a list of words after a single presentation, but with repeated trials, the alcoholic patients learned fewer additional words than did the controls.Ryan also showed that abstinent alcoholics took substantially longer time than controls to learn a word list, but when he provided the abstinent alcoholics with mnemonic strategies for learning and remembering the words, they did as well as the control groups.

(Ryan et al, 1980)

The implications from the above results is that recovering alcoholics have particular difficulty in generating effective strategies for remembering which may be due to their problems in organization on complex new tasks. (George Fein et al, 1990)

3. Cognitive impairment during Long-term Abstinence (Greater Than 2 Months):

Cognitive functions like abstract reasoning, visuospatial ability, short-term memory, and mental flexibility takes several years to recover. Age and number of relapses are important factors that influence the extent of the recovery.

Grant and co-workers have suggested using the terms"intermediate-duration organic mental disorder" or "subacute organic mental disorder" to characterize the slow recovery process associated with prolonged abstinence.

(Grandt et al 1986, 1987)

Leber et al in 1981, examined learning and memory in control group and two groups of alcoholics abstinent for 3 and 11 weeks, respectively and no significant differences among the three groups were observed in verbal-learning abilities. However, on a visuo spatial learning task and on memory for designs, both the short-term-abstinent alcoholics and the long term

alcoholics performed poorly than controls and short term abstinent alcoholics performed poorer than long term abstinent alcoholics. The same results were inferred from a study done on visuo spatial memory by Fabian and Parsons in 1983. Similarly for memory for designs task, the short-term-abstinent alcoholics were impaired compared with the long term-abstinent alcoholics.

Studies done on digit symbol substitution test, a test of mental speed on short term abstinents, long term abstinents and controls inferred that alcoholics perform poorly than controls though it was not statistically significant. And performance of long term abstinents was better compared to short-term-abstinent alcoholics.
(Ryan et al, 1980)

In a study done by Brandt and co-workers in 1983 who studied prolonged- abstinent alcoholics (minimum of five years of abstinence) and found that they perform at levels indistinguishable from those of controls. A study on comparison of alcoholics with matched controls, it was found that there were no significant difference between alcoholics and controls in learning and memory but alcoholics performed poorly on verbal abilities, abstracting, problem solving skills and perceptual motor abilities. In this study they separated the alcoholics who maintained abstinence for 13 months and those who resumed drinking.They found that the abstainers

had improved in learning, memory, abstracting and problem-solving, and verbal abilities, whereas the intermittent resumers had improved only in verbal abilities. The alcoholics who maintained abstinence performed significantly worse than controls on perceptual-motor tasks 13 months after initial testing. These results show that alcoholics who resume drinking, even at a reduced level, do not achieve the same cognitive function as their abstinent peers and that even abstinent alcoholic do not fully recover in their cognitive abilities after 13 months.

(Yohman et al, 1985)

As there were residual deficits even after prolonged abstinence, studies were undertaken to find if other factors were responsible in influencing the recovery of impairment. Goldman and colleagues in 1983 studied the effect of age on the recovery of visuospatial impairments in abstinent alcoholics. It was concluded that age itself was the critical variable in the failure of recovery of these aspects of cognitive functioning.

With the findings from above study, further studies were done to analyse the influence of age. Brandt and co-workers in 1983 studied younger (mean age 42.2 years) and older (mean age 55.1 years) abstinent alcoholics after seven years of abstinence and found that some cognitive changes may not be reversible even in younger abstinent alcoholics .It was noted that cognitive deficits did persist in the learning of new verbal associations

even in younger groups but short term memory and psychomotor performance had returned to normal levels. This study implies that some of the cognitive impairments associated with severe alcoholism may be permanent, even in relatively young alcoholic persons.

Other studies which suggests that alcohol related cognitive impairment attenuates over time after cessation of drinking are as follows: De soto et al, 1985; Grant et al, 1987; Munro et al, 2000; Rourke and Grant et al, 1987; Munro et al, 2000; Reed et al, 1992.

Though there are numerous studies indicating recovery of cognitive impairment during abstinence, studies to understand the residual deficits after abstinence reveal that factors such as age, poor nutritionand medical comorbidity seem to diminish the extent and prolong the time course of recovery.

(Munro et al, 2000; Rourke and Grant, 1999; Lotfi and Meyer 1989; Skinner et al, 1989, Adams and Grant, 1986; Edwin et al, 1999; Solomon and Malloy, 1992)

The executive functioning may recover with the cessation of drinking though systematic studies have been lacking (Zinn et al,2004). Abstraction abilities, perceptual motor speed and spatial abilities show some recovery

within several months of abstinence, but short-term or working memory has proved more resistant to recovery

(Mann et al, 1999; Rourke and Grant, 1999; Kish et al, 1980)

Although mild to moderate cognitive deficits have been documented in a significant percentage of recovering alcoholics like visuo spatial abilities, psychomotor speed, executive functions, such as working memory, problem solving, temporal ordering, and response inhibition and gait and balance it is said that functions tend to be impaired and not completely lost in both alcoholic men and women.

(Fein et al. 1990; Moselhy et al. 2001; Nixon et al. 2002; OscarBerman 2000; OscarBerman and Marinkovic 2007; Sullivan et al 2000, Sullivan et al. 2002*b*, Sullivan et al. 2000*c*).

Longitudinal neuropsychological studies report significantly better scores on tests of working memory, visuo spatial abilities with abstinence from alcohol. Some of the components of functional cognitive domains recover faster and even completely than others, but atleast a measurable degree of impairment during recovery typically accompanies prolonged sobriety. This suggests that the changes observed with neuro imaging have functional consequences in the form of cognitive impairment.

(Rosenbloom et al. 2004, Becker et al. 1983; Brandt et al. 1983; Mann et al. 1999; Nixon and Glenn 1995; Parsons et al. 1987; Sullivan et al. 2000*b*)

O'Leary et al in 1977 demonstrated that within the first year of abstinence, performance of alcohol-dependent patients in attention and executive function, improved significantly which further adds the evidence of cognitive recovery during abstinence.

In a more recent study, Fein et al. (2006) demonstrated that long-term abstinent patients (average of 6.7 years) performed similarly to healthy controls on a wide range of neuropsychological measures as already discussed with impairment observed only with regard to deficits in the spatial processing domain.

From the above evidence it can be inferred that cognitive impairment improves with abstinence but the domain of cognitive functions which improves and the domain of cognitive functions which remains impaired as residual deficits is not clear. Moreover, the duration of cognitive recovery after cessation of drinking is not clear. Some studies have shown partial recovery with 14 to 20 days of abstinence whereas others have concluded that cognition is relatively stable through early abstinence.

(Carlen et al, 1984; Eckardt et al, 1979; Mann et al, 1999; Unkenstein and Bowden, 1991; Volkow et al, 1994).

Imaging evidence for reversal of structural changes during abstinence

With evidence from many neuropsychological studies on recovery of cognitive functions during recovery, it becomes essential to corroborate this evidence through imaging studies.

The brain structural abnormalities that had occurred due to chronic use of alcohol are at least partially reversible with abstinence, through remyelination, neurogenesis, or simple cellular revoluming, and this reversible brain changes are accompanied by improvement in cognitive, sensory, and motor functions.

This evidence has been proved even 20 years ago by Carlen and colleagues (1986) using computerized tomography (CT), an X-ray based brain imaging technique to demonstrate that the negative consequences of chronic excessive alcohol use on the brain are mitigated to some extent by maintaining sobriety.

Evidence from longitudinal MRI studies of alcoholics during short term treatment–related abstinence (about 1 month), followed by continued abstinence or relapse after discharge, have found that the cortical grey matter, overall brain tissue and hippocampal structures increase in volume in patients with short term abstinence. In patients who maintain abstinence after discharge shows reduced volume of the third ventricle or a general increase in brain volume that favors frontal and temporal lobes. In patients

who relapse show expansion of third ventricle, shrinkage of white matter and loss of overall brain tissue.

(Pfefferbaum et al. 1995; Bartsch et al. 2007; Gazdzinski et al. 2005*a;* Gazdzinski et al. 2008*b* ; Gazdzinski et al. 2005*a*; Cardenas et al. 2007)

Also there are studies which have established that the cortical white matter volume may be particularly amenable to recovery with maintainance of abstinence and vulnerable to decrease with continued drinking.
(Agartz et al. 2003; Meyerhoff 2005; O'Neill et al. 2001; Shear et al. 1994; Pfefferbaum et al. 1995).

With the evidence of structural analysis demonstrating that improvement in brain structure may be associated with cognitive impairment in recovering alcohol dependent patients, next step is to identify the functions of brain regions and to find any alterations during performance of any task for which fMRI is used. fMRI is used to identify which regions of brain are stimulated while performing a task and how alcoholics and control participants differ in the systems activated While performing the task. The findings from all of these studies are that alcoholics achieve normal levels of performance but accomplish this by activating brain regions that are different from controls. This implies an interesting finding that a

compensatory reorganization takes place on alcoholic patient's brain to enable them to perform at non-impaired levels.

(Margaret J.Rosenbloom and Adolf Pfefferbaum, 2008)

Impact of Cognitive deficits on treatment

Ultimately, identifying Cognitive impairment in patients with substance use disorders becomes essential due to its impact on treatment. Cognitive impairment contributes to poorer treatment outcomes: Decreased treatment retention and less abstinence from substances of abuse.

(Aharonovich et al 2006; Aharonovich, nunes, and Hasin, 2003; Donovan, Kivlahan, Kadden, and Hill; Fals-Stewart,1993; Fals-Stewart and Schafer,1992)

Studies have shown that Cognitive dysfunction has been shown to have a negative impact on "therapeutic mechanisms of change" like:

Less treatment adherence, less treatment engagement, less readiness to change, lower self efficacy, decreased insight, increased denial of addiction, greater reflection of impulsivity and negative impact on drink refusal skill acquisition and aftercare treatment attendance.

(Bates, Pawlak, Tonigan and Buckman, 2006; Katz et al 2005; Blume, Schmaling and Marlatt, 2005; Bates et al,2006; Horner, Harvey and

Denier, 1999; Shelton and Parsons, 1987; Rinn et al, 2002; Clark et al, 2006; Smith and McCrady, 1991; Persino et al 2011)

Among the cognitive impairment identified executive function deficits are the most likely to affect rehabilitation success.

(Ihara et al, 2000)

When the residual cognitive impairment after detoxification typically includes executive functions, learning and memory as well as visuospatial processing and perceptual or motor integration as evidenced by the following studies (Noel et al,2001; Parsons, 1986; Rourke and Loberg, 1996; Sullivan et al, 2000), patient's ability to use rehabilitative information is likely to be compromised during this period

(Ihara et al, 2000; McCrady and Smith, 1986)

There are established studies to show that cognitive impairment affects prognosis for treatment success and that moderate cognitive impairment compromises the learning of treatment content.

(Parsons, 1983; Becer and Jaffe, 1984; Godding et al, 1992; Smith and Mc Crady, 1991)

Also study by Miller in 1991 show that not only cognitive impairment of executive functions in alcoholics has been associated with attrition from

rehabilitation as established in previous studies, it is also associated with higher rates of relapse.

It can also cause social difficulties such as increased marital disruption and employment failure all of which conspire towards poor treatment outcomes. (Tuck and jackson, 1991; Moriyama et al, 2002)

Effect of repeated withdrawal on cognition

Chronic alcohol consumption leads to a prolonged inhibition of the N-methyl-D-aspartate (NMDA) receptor. And during withdrawal there is a rebound increase in glutamate release. Hence during abrupt cessation the increased glutamate causes excitotoxicity leading to cell death.
(Lovinger, 1993; Tsai and Coyle, 1998)

Frontal lobes being rich in glutamatergic pathways , the glutamate mediated excitotoxicity may affect the frontal lobes, and can result in frontal lobe deficts. Though these mechanisms have been studied in animals, there is less well established studies in humans for understanding this as a mechanism of effect on brain due to repeated withdrawal. (Kril et al., 1997)

Cognitive retraining in abstinent alcoholics

Cognitive retraining is useful in improving some of the cognitive functions of detoxified abstinent alcoholics. The cognitive retraining target focused, sustained, divided attention, information processing, planning and reasoning.

Abstinence alone does not improve cognitive functions as evidenced by studies showing residual deficits. However, when abstinence is combined with cognitive retraining some of the fundamental cognitive functions improve. It is also mentioned that cognitive retraining does not have an impact on long term abstinence. The improvement occurs in as brief a time as 6 weeks.

This improvement of cognition would have wide ranging implications for the patient's life. The patient's functioning in vocational and family spheres would improve. Improvement of speed of information processing and memory would lead to a more efficient work performance. The patient would be able to remember the commitments made to the family and friends better. This would lead to a reduction in its interpersonal conflicts and improve the quality of relationship at home and in the work place. Another major gain of improving the cognitive functioning is that alcoholic patients would become receptive to the psychotherapy and counselling. A better understanding and memory of what is happening in the therapy session would make the patient receptive to it and eventually benefit

from it.

The above findings are derived from a study done by Grace Mathai and co workers in 1998 in a small group (about 8) of alcohol dependent patients. Hence the results cannot be generalised to the entire group of study population but these findings have to be kept in mind.

Indian studies on cognition in alcohol dependent patients:

Sabhesan et al, 1990: Compared 11 alcohol dependent head injured patients continuing to consume alcohol, 11 alcohol dependent head injured patients abstaining from alcohol, 11 non- alcoholic head injured patients using PGI memory scale and found that the poorest performers were head injured persistent alcohol abusers and abstinence was followed by a welcome change.

Narang et al, 1991: Cognition was assessed using PGI battery of brain dysfunction in 30 alcoholic patients and it was found that significant relationship exist between cognitive impairment and duration of alcohol use.

Saraswat et al, 2006: Compared 30 alcohol dependent patients and 15 controls using trail making and stroop test. It was found that patient group performed poorly compared to controls and duration of abstinence over past one year correlated with the performance of stroop test.

AIM AND OBJECTIVES

AIM: To assess the cognitive functions in abstinent alcohol dependent males and to find its correlation with the duration of abstinence.

OBJECTIVES:

1. To assess the cognitive functions (mental speed, sustained attention, divided attention, verbal working memory, visual working memory, planning, verbal learning and memory, logical memory, visuoconstructive ability & visual memory and cognitive flexibility) in abstinent alcohol dependent males and control subjects.
2. To compare the cognitive functions in abstinent alcohol dependent males and control subjects.
3. To find any correlation between the duration of abstinence and cognitive functions in the study group.

NULL HYPOTHESIS

1. There is no difference in mental speed between study and control group.
2. There is no difference in sustained attention between study and control group.
3. There is no difference in divided attention between study and control group.
4. There is no difference in verbal working memory between study and control group.
5. There is no difference in visual working memory between study and control group.
6. There is no difference in planning between study and control group.
7. There is no difference in verbal learning and memory between study and control group.
8. There is no difference in logical memory between study and control group.
9. There is no difference in visuo constructive ability and visual memory between study and control group.
10. There is no difference in cognitive flexibility between study and control group.
11. There is no significant correlation with the duration of abstinence and cognitive functions in the study group.

MATERIALS AND METHODOLOGY

1. A Semi structured performa for sociodemographic data.
2. Relevant clinical history from patients and informants
3. Subtests from NIMHANS neuropsychological battery (2004)
    a) Digit symbol substitution test
    b) Digit vigilance test
    c) Triads test
    d) Verbal N back test
    e) Visual N back test
    f) Tower of London test
    g) Auditory verbal learning test
    h) Logical memory test
    i) Complex figure test
4. Trial making test: part A and part B

METHODOLOGY

The study was a cross sectional study done in Institute of Mental Health, Chennai among alcohol dependent male patients who were admitted in de-addiction ward and among those attending the review clinics. The number of study group chosen based on inclusion and exclusion criteria was 30. The control population were the staffs working in IMH, Chennai and friends of patients attending IMH. The number of control group selected based on inclusion and exclusion criteria was 30. Informed consent was obtained from both groups prior to the commencement of the study.

Inclusion criteria of study group:

1. Male patients from 18 to 50 years of age
2. Consent and cooperation for examination
3. Fulfilled ICD- 10 criteria for alcohol dependence syndrome, not in withdrawal, without psychotic disorder
4. Completed detoxification
5. Abstinent from alcohol for 3weeks or more
6. >= 6 years of education

Exclusion criteria of study group:

1. < 18years or > 50years, females
2. Other comorbid Axis I disorders
3. History of head injury, medical illness, neurological illness
4. < 3 weeks of abstinence
5. Other drug dependence or abuse except tobacco
6. On any psychotropic medications except benzodiazepines, anticraving drugs and disulfiram
7. Patients in withdrawal state or with psychotic disorder
8. < 6 years of education

Inclusion criteria of control group:

1. Age and education matched male controls
2. Consent and cooperation for examination

Exclusion criteria of control group:

1. <18years or >50years, females
2. History of head injury, medical illness, neurological illness
3. History of any drug dependence or abuse except tobacco
4. Axis I disorders
5. Not on any psychotropic medications

The interview and assessment were conducted in hospital during admission of the patients and also in review clinics in a single sitting. Minimum 3 weeks of abstinence was chosen because the severe cognitive impairment due to the direct effect of alcohol and due to the immediate withdrawal symptoms which may interfere with the patient's test performance. The neuropsychological assessment during this initial period is of little value as this impairment will improve substantially with detoxification. Patients with history of head injury, medical illness, neurological illness, psychotic disorder, other substance dependence or abuse, other comorbid axis I disorders were excluded as it may interfere with the neuropsychological assessment. Patients aged more than 50years were excluded to rule out the influence of age on cognition and patients aged less than 18 years were as excluded as adolescent alcohol dependent males have higher rate of comorbid psychiatric disturbances which might influence the cognitive function independently.

NIMHANS Neuropsychological Battery (2004)

1. **Digit Symbol Substitution Test**

   It is administered to test the mental speed. It also tests visuomotor coordination, motor persistence and sustained attention. The test consists of a sheet in which numbers 1 to 9 are randomly arranged in

4 rows of 25 squares each. The subject substitutes each number with a symbol using a number symbol key given on top of the page.

2. **Digit Vigilance Test**

   It tests the sustained attention. It consists of 1 to 9 randomly ordered and placed with 30 digits per row and 50 rows totally. The subject has to focus on the target digits 6 and 9 among other distracter digits.

3. **Triads Test**

   It tests the divided attention. This combines a verbal triad task with a tactual number identification task. Subjects are blindfolded. In verbal triad task subject has to name the odd word from each group of 3 words and has about 16 word triads. In tactual number identification task, a single or double digit Arabic numeral is written on subject's non dominant hand.

4. **Verbal N Back Test**

   It tests the verbal working memory which is an executive function. 30 randomly ordered consonants are presented verbally. In 1 back test subject responds whenever a consonant is repeated and in 2 back test subject responds whenever a consonant is repeated after an intervening consonant.

5. **Visual N Back Test**

   It tests the visual working memory. Only the visual 1 back test component is used in the study. It consisted of 36 cards each of

which had one black dot placed randomly. The subject was told to respond whenever the location of the dot repeated itself.

6. **Tower of London Test**

   The test evaluates the subject ability to plan and anticipate the results of their actions to achieve a predetermined role which is an executive function. The subject is presented with a goal state of arrangement of the three balls on a board an instructed to make the minimum number of moves to achieve a final goal. The time taken to achieve the final goal is also noted.

7. **Rey's Auditory Verbal Learning Test**

   It tests the capacity to learn and remember verbal material. There are two lists A & B with 15 different words in each list. Words in list A are presented for 5 successive trials. Each trial consists of presentation of 15 words immediately followed by recall. Presentation of list B serves as interference. After a delay of 20 minutes words from list A are again recalled. Following delayed recall recognition of words in list A is tested.

8. **Logical Memory Test**

   The test consists of a short story with 21 facts. Immediate recall is assessed after the story is read out and delayed recall is assessed after a delay of 30 minutes. Number of facts remembered is noted.

9. **Complex Figure Test**

It tests the visuo constructive ability. Visuo constructive ability requires attention, visuo spatial perception, visuo motor coordination, planning and error correction abilities. It is tested using Rey's complex figure test and subjects were instructed to copy the complex figure. The same test is also used to assess visual learning and memory by drawing the complex figure 3 minutes after the copy test and 30 minutes later.

10. **Trail Making Test**

It tests the attention, visual search, scanning, speed of processing, mental flexibility and executive function. It consists of Part A and Part B. Patients are instructed to connect the circles numbered from 1 to 25 in ascending order in Part A. In Part B, the sheet has circles numbered from 1 to 13 and alphabets from A to L. Patients are instructed to connect the circles in ascending order but alternating between numbers and alphabets. The time taken to complete the both the tasks is noted separately.

DATA ANALYSIS AND RESULTS

Cognitive functions were assessed in 30 study subjects and 30 control subjects. Chi square test was applied to compare the sociodemographic details between study and control group. Student T- Test was applied to compare the mean values between cases and control groups for comparison of cognitive functions. Pearsons correlation coefficient was applied to find any correlation between duration of abstinence and cognitive functions in the study group. P value < 0.05 was kept significant. The results are as follows:

Table 1.1

Description of Sociodemographic Details

Sociodemographic details		Group				Total		P-Value
		Case		Control				
		N=30	%	N=30	%	N	%	
Education	6 to 12yrs	20	66.7	18	60.0	38	63.3	0.592
	> 12yrs	10	33.3	12	40.0	22	36.7	
Marital Status	Unmarried	4	13.3	9	30.0	13	21.7	0.117
	Married	26	86.7	21	70.0	47	78.3	
Occupation	Unskilled	6	20.0	6	20.0	12	20.0	0.999
	Skilled	24	80.0	24	80.0	48	80.0	

Religion	Hinduism	21	70.0	27	90.0	48	80.0	0.201
	Christianity	6	20.0	2	6.7	8	13.3	
	Islam	3	10.0	1	3.3	4	6.7	
Income	< Rs.2000	6	20.0	5	16.7	11	18.3	0.562
	Rs.2000 to Rs.5000	24	80.0	23	76.7	47	78.3	
	> Rs. 5000	0	0.0	2	6.7	2	3.3	
Total		30	100.0	30	100.0	60	100.0	

(N- number)

Table 1.2

Age distribution in both cases and controls

	Group	N	Mean	S.D	P-Value
Age (in years)	Case	30	39.330	7.092	0.860
	Control	30	39.000	7.497	

(N- number, S.D- standard deviation)

Chisquare test was applied to assess the proportions between cases and controls. More than half of the cases and controls (About 66.7% of cases and 60% of controls) had 6 to 12 years of education. Most of them were married, about 86.7% of cases and 70% of controls were married. Most of the cases and controls were skilled workers (80% each of both cases and controls). 70% of cases and 90% of controls belonged to Hinduism by

religion. Most of the cases and controls (80% of cases and 76.7% of controls) earned income in the range of Rs.2000 to Rs.5000. There were no significant association between cases and controls in the socio demographic characteristics. The mean age of study group was 39.33+/-7.092 and the mean age of control group was 39+/-7.497 and there is no significant association in the mean age between study and control group. The mean duration of abstinence was 43.57+/-39.425 days.

Comparison of Cognitive functions between cases and controls:

Table 2.1

Comparison of time taken (in seconds) for digit symbol substitution test by T-test:

Digit Symbol Substitution Test	Group	N	Mean	SD	P-Value
Time Taken (In Seconds)	Case	30	391.5	129.1	**0.009***
	Control	30	315.3	83.2	

(N- number, S.D- standard deviation, *p< 0.05)

The time taken in seconds by cases and controls are mean= 391.5, S.D= 129.1 and mean= 315.3, S.D= 83.2.

There is a significant difference between both groups in the time taken to complete the task in digit symbol substitution test which is a measure of mental speed, between cases and control groups when compared by by T-test with p value <0.05.

Table 2.2

Comparison of number of errors in digit vigilance test by T-test:

Digit Vigilance Test	Group	N	Mean	S.D	P-Value
No of Errors (Omission and Commission)	Case	30	4.670	1.729	0.213
	Control	30	4.130	1.548	

(N- number, S.D- standard deviation)

The number of errors made by cases and controls are mean= 4.670, S.D= 1.729 and mean= 4.130, S.D= 1.548 respectively.

There is no significant difference between both groups in number of errors in digit vigilance test which is a measure of sustained attention when compared by T-test with p value >0.05.

Table 2.3

Comparison of number of errors in triads test by T- test:

Triad Test	Group	N	Mean	S.D	P-Value
Errors (Word and Tactile)	Case	30	3.500	1.737	0.456
	Control	30	3.170	1.704	

(N- number, S.D- standard deviation)

The number of errors made by study and control group are mean= 3.5, S.D= 1.737 and mean= 3.17, S.D= 1.704 respectively.

There is no significant difference between both groups in triads test (no. Of errors), which is a measure of divided attention when compared by T- test with p-value falling >0.05.

Table 2.4

Comparison of hits and errors in 1 back and 2 back tests respectively by T- test:

Verbal N Back	Group	N	Mean	S.D	P-Value
1 Back: Hits	Case	30	8.070	1.337	**0.041***
	Control	30	8.630	0.615	
1 Back: Errors	Case	30	1.200	1.606	**0.020***
	Control	30	0.430	0.626	
2 Back: Hits	Case	30	5.070	1.721	**0.001***
	Control	30	6.530	1.570	
2 Back: Errors	Case	30	5.030	2.266	**0.033***
	Control	30	3.800	2.091	

(N- number, S.D- standard deviation, * $p<0.05$)

There is a significant difference between both groups in all components of verbal N back test (both 1 back and 2 back) when compared by T- test with p value <0.05 indicating poor verbal working memory in study group compared with control group.

Table 2.5

Comparison of number of hits and errors in visual 1 back test by T-test:

Visual N Back	Group	N	Mean	S.D	P-Value
1 Back: Hits	Case	30	7.530	1.106	0.541
	Control	30	7.700	0.988	
1 Back: Errors	Case	30	2.370	1.426	0.770
	Control	30	2.270	1.202	

(N- number, S.D- standard deviation)

There is no significant difference in visual N back test, which is a measure of visual working memory between both groups when compared by T-test with p value falling >0.05.

Table 2.6

Comparison of mean time, mean moves in each of trial 2, trial 3, trial 4 and trial 5 respectively and comparison of total number of problems solved with minimum number of moves in tower of London test by T-test:

Tower of London	Group	N	Mean	S.D	P-Value
Trail 2: Mean Time	Case	30	5.750	1.770	0.161
	Control	30	5.130	1.585	
Trail 2: Mean Moves	Case	30	2.100	0.203	0.107
	Control	30	2.030	0.086	
Trail 3: Mean Time	Case	30	8.130	1.563	**0.012***
	Control	30	9.510	2.417	
Trail 3: Mean Moves	Case	30	3.860	0.697	0.504
	Control	30	3.740	0.645	
Trail 4: Mean Time	Case	30	15.320	4.228	0.208
	Control	30	16.760	4.545	
Trail 4: Mean Moves	Case	30	5.360	1.104	0.081
	Control	30	4.880	0.999	
Trail 5: Mean Time	Case	30	25.230	5.717	0.089
	Control	30	22.580	6.168	
Trail 5: Mean Moves	Case	30	6.830	1.390	**0.018***

	Control	30	6.050	1.041	
Total No Problems with Minimum Moves (TNPMM)	Case	30	7.400	3.035	**0.001***
	Control	30	9.730	1.946	

(N- number, S.D- standard deviation, *p<0.05)

The study group performed poorly compared to controls in trial 3 and took longer time to achieve the goal compared to controls and performed poorly in trial 5 and took many moves to achieve the goal in tower of London test which is a measure of planning, when both groups were compared by T-test with p value <0.05. No significant difference were noted in other trials. There was also a significant difference between both groups in total number of problems solved with minimum moves with p value <0.05.

Table 2.7

Comparison of number of words learned in trial 1, trial 5, number of recognition hits, errors (omissions and false alarm) and number of words recalled (immediate and delayed) by T-test:

Auditory Verbal Learning Test	Group	N	Mean	S.D	P-Value
Trail 1	Case	30	7.370	1.921	0.068
	Control	30	8.370	2.236	
Trail 5	Case	30	13.730	1.143	0.269
	Control	30	14.030	0.928	
Recognition Hits	Case	30	14.630	0.556	**0.026***
	Control	30	14.900	0.305	
Omissions	Case	30	0.370	0.556	**0.026***
	Control	30	0.100	0.305	
False Alarm	Case	30	0.030	0.183	0.326
	Control	30	0.000	0.000	
Immediate Recall	Case	30	14.030	1.159	**0.009***
	Control	30	14.670	0.479	
Delayed Recall	Case	30	13.730	1.202	**0.010***
	Control	30	14.430	0.774	

(N- number, S.D- standard deviation, *p<0.05)

There was a significant difference between both groups in auditory verbal learning test in both immediate and delayed recall of words and also significant difference in number of recognition hits and omissions in both groups when compared by T-test with p value falling <0.05. No significant difference was noted in auditory verbal learning test in trial 1, trial 5, false alarm with p value >0.05.

Table 2.8

Comparison of number of facts recalled (immediate and delayed) in logical memory test by T- test:

Logical Memory	Group	N	Mean	S.D	P-Value
Immediate Recall	Case	30	11.730	1.311	0.204
	Control	30	12.200	1.495	
Delayed Recall	Case	30	10.470	1.570	**0.017***
	Control	30	11.400	1.354	

(N- number, S.D- standard deviation, *p<0.05)

There was a significant difference between both groups in the delayed recall in logical memory test with p value <0.05 when compared by T-test but no significant difference were noted in the immediate recall of facts with p value >0.05.

Table 2.9

Comparison of copy and recall (immediate and delayed) in complex figure

test by T- test:

Complex Figure Test	Group	N	Mean	S.D	P-Value
Copy	Case	30	35.170	0.950	0.176
	Control	30	35.470	0.730	
Immediate recall	Case	30	20.750	7.727	**0.016***
	Control	30	25.220	6.140	
Delayed recall	Case	30	19.800	7.737	**0.014***
	Control	30	24.370	6.214	

(N- number, S.D- standard deviation, *p<0.05)

There was no significant difference between both groups in copy of complex figure when compared by T- test with p value >0.05. but there was a significant difference between both groups in the immediate recall and delayed recall of complex figure with p value <0.05.

Table 2.10

Comparison of time taken (in seconds) to complete both part A and part B

by T- test:

Trail Making Test	Group	N	Mean	S.D	P-Value
Part A	Case	30	39.730	9.040	**<0.001***
	Control	30	31.130	6.394	
Part B	Case	30	110.370	29.527	**<0.001***
	Control	30	83.270	13.370	

(N- number, S.D- standard deviation, *p<0.05)

There was a significant difference between both groups in trial making test both part A and part B i.e the time taken to complete the task in both parts and study group took significantly longer time compared to controls when both the groups were compared by T- test with p value <0.05.

Correlation between Duration of abstinence and cognitive functions in the study group by Pearson's correlation coefficient:

Table 3.1

Correlation between duration of abstinence with digit symbol substitution test:

Digit Symbol Substitution Test		Duration Of Abstinence
Time taken (in seconds)	Correlation (r)	-0.368
	P-Value	**0.045***
	N	30

(N- number, *p<0.05)

There is a significant negative correlation between duration of abstinence and the time taken to complete the test which implies that if the duration of abstinence increases the time taken to complete the task is reduced i.e better performance of test.

Table 3.2

Correlation between duration of abstinence with digit vigilance test:

Digit Vigilance Test		Duration Of Abstinence
Errors (Omission and Commission)	Correlation (r)	-0.282
	P-Value	0.131
	N	30

No significant correlation was found between duration of abstinence and the errors in alcohol dependent group with p value >0.05 which implies that the duration of abstinence does not improve sustained attention.

Table 3.3

Correlation between duration of abstinence and errors in triad test:

Triad Test		Duration Of Abstinence
Errors (Word and Tactile)	Correlation (r)	-0.359
	P-Value	0.051
	N	30

No significant correlation was found between the duration of abstinence and errors in the triad test with p value > 0.05 which implies that the duration of abstinence does not improve divided attention.

Table 3.4

Correlation between duration of abstinence and verbal N back test:

Verbal N Back		Duration Of Abstinence
1 Back: Hits	Correlation (r)	0.252
	P-Value	0.180
	N	30
1 Back: Errors	Correlation (r)	-0.200
	P-Value	0.289
	N	30
2 Back: Hits	Correlation (r)	0.100
	P-Value	0.601
	N	30
2 Back: Errors	Correlation (r)	-0.028
	P-Value	0.882
	N	30

No significant correlation was found between the duration of abstinence and the number of hits and errors in both 1 back and 2 back test which implies that the duration of abstinence does not improve verbal working memory.

Table 3.5

Correlation between duration of dependence with the visual 1 back test:

Visual N Back		Duration Of Abstinence
1 Back: Hits	Correlation (r)	0.448
	P-Value	**0.013**
	N	30
1 Back: Errors	Correlation (r)	-0.306
	P-Value	0.100
	N	30

(N- number, *p<0.05)

There is a significant positive correlation between the duration of abstinence with the number of hits in visual 1 back test which implies that as the duration of abstinence increases visual working memory improves.

Table 3.6

Correlation between tower of London tests with the duration of abstinence:

Tower Of London		Duration Of Abstinence
Trail 2: Mean Time	Correlation (r)	-0.315
	P-Value	0.090
	N	30
Trial 2: Mean Moves	Correlation (r)	-0.003
	P-Value	0.987
	N	30
Trial 3: Mean Time	Correlation (r)	-0.390
	P-Value	**0.033**
	N	30
Trial 3: Mean Moves	Correlation (r)	-0.372
	P-Value	**0.043**
	N	30

Trial 4: Mean Time	Correlation (r)	-0.302
	P-Value	0.105
	N	30
Trial 4: Mean Moves	Correlation (r)	-0.360
	P-Value	0.051
	N	30
Trial 5: Mean Time	Correlation (r)	-0.204
	P-Value	0.280
	N	30
Trial 5: Mean Moves	Correlation (r)	-0.415
	P-Value	**0.022**
	N	30
Total No Problems with Minimum Moves (TNPMM)	Correlation (r)	0.290
	P-Value	0.121
	N	30

(N- number, *p<0.05)

There is a significant negative correlation between mean time and mean moves of trial 3, mean moves of trial 5 and no other significant correlations between other parameters of tower of London test with the duration of abstinence. The correlation is patchy among the 4 trials. Even then it implies better performance of tests with increased duration of abstinence.

Table 3.7

Correlation between auditory verbal learning tests with duration of abstinence:

Auditory Verbal Learning Test		Duration Of Abstinence
Trail 1	Correlation (r)	0.439
	P-Value	**0.015**
	N	30
Trial 5	Correlation (r)	0.458
	P-Value	**0.011**
	N	30
Hits	Correlation (r)	0.271
	P-Value	0.148

	N	30
Omission	Correlation (r)	-0.271
	P-Value	0.148
	N	30
False Alarm	Correlation (r)	-0.103
	P-Value	0.587
	N	30
Immediate Recall	Correlation (r)	0.316
	P-Value	0.089
	N	30
Delayed Recall	Correlation (r)	0.372
	P-Value	0.043
	N	30

There is a significant positive correlation between verbal learning of words in trial 1 and trial 5 and also significant positive correlation between delayed recall of words with the duration of abstinence. This implies that

verbal learning of words and delayed recall of words improves as the duration of abstinence increases.

Table 3.8

Correlation between logical memory tests with the duration of abstinence:

Logical Memory		Duration Of Abstinence
Immediate Recall	Correlation (r)	0.285
	P-Value	0.127
	N	30
Delayed Recall	Correlation (r)	0.391
	P-Value	**0.033**
	N	30

(N- number, *p<0.05)

There is a significant positive correlation between the duration of abstinence and the delayed recall of facts and it implies that as the duration of abstinence increases delayed recall of facts improves.

Table 3.9

Correlation between complex figure test and duration of abstinence:

Complex Figure Test		Duration Of Abstinence
Copy	Correlation (r)	0.261
	P-Value	0.164
	N	30
Immediate Recall	Correlation (r)	0.513
	P-Value	**0.004**
	N	30
Delayed Recall	Correlation (r)	0.531
	P-Value	**0.003**
	N	30

(N- number, *p<0.05)

There is significant positive correlation between immediate recall and delayed recall of figure with the duration of abstinence and it implies that as the duration of abstinence increases the performance in immediate and delayed recall of figure improves.

Table 3.10

Correlation between trail making test and duration of abstinence:

Trial Making		Duration Of Abstinence
Part A	Correlation (r)	-0.492
	P-Value	**0.006**
	N	30
Part B	Correlation (r)	-0.372
	P-Value	**0.043**
	N	30

There is a significant negative correlation between the time taken to complete trail making tests, both part A and part B with duration of abstinence which implies that as the duration of abstinence increases, the time taken to complete both part A and part B decreases.

DISCUSSION

The study shows that the abstinent alcohol dependent males perform poorly when compared to control groups in mental speed, sustained attention, verbal working memory, logical memory, verbal memory, visuo constructive ability and executive functions (planning, speed of processing, cognitive flexibility).

In our study it has been shown that study group's performance on timed tasks as in mental speed, trail making test, tower of London test was poorer compared to controls which indicates frontal lobe dysfunction in the study group.

These results have also been established in previous studies. In the study of executive functioning early in abstinence from alcohol, Sandra Zinn et al, 2004 has discussed that there is a greater discrepancy between alcohol abusing patients and controls especially in timed tasks with a motor component, visual perception elements and those which uses working memory.

The same has also been established by S.J.C. Davies et al, 2005 in a population of apparently clinically healthy abstinent alcohol-dependent subjects where he found impaired frontal lobe function as evidenced by

poorer task performance on the Trail Making Test and digit symbol test of the WAIS-R compared with control subjects which are again timed tasks.

Though the difference between study group and control group on digit vigilance test and triad test which are tests for sustained attention and divided attention was not significant, performance of study group was on the lower side compared to control population.

Our study has shown impairment of verbal working memory in study group compared to controls but no significant difference between both groups in visual working memory. In a study by Zdrav Vestn on neurocognitive assessment of alcoholic patients during recovery from alcoholism, he illustrated that though both study and control group did not differ significantly in both spatial and verbal memory, it was found that alcohol abstainers had less accuracy during the task as the number of errors made in this group was higher compared to controls. Similarly in our study the number of errors made by the study group in verbal memory is significantly higher and the number of errors in visual working memory though not significant was higher compared to controls.

Our study has included tower of London test which tests exclusively the ability to plan and it is a function of frontal lobe. The study group

performed fairly well though at a lower level compared with controls except in trial 3, trial 5 and total number of problems solved with minimum moves in which both group differed significantly. This indicates that planning strategies of cases compared to controls are poorer. This issue has also been discussed by George Fein et al, 1990 that intermediate term abstinent alcoholics perform more poorly than non alcoholic persons on tests of problem solving and abstraction abilities.

Our study group also showed significant impairment in immediate and delayed recall of verbal material as well as visual memory when compared with controls. It has been said that impairment in memory and learning in abstinent alcoholics have been reported less frequently but they are now receiving increasing attention (George Fein, 1990). Tarter and Edwards in 1985 report that learning and memory deficits were not observed when standard clinical tests were employed but with a more challenging laboratory tasks there were learning and memory deficits. Ryan C butters, 1980; becker JT et al, 1983; brandt J et al, 1983; ron MA et al, 1980 have reported short term memory impairments and learning deficits in both verbal and nonverbal tasks. There are also studies which report impaired performance in verbal memory but not in non verbal memory task in abstinent alcohol dependent subjects compared to controls similar to our results.(S.J.C.Davies et al, 2005)

Our study also shows poor performance of study group in visual scanning, attention, suppression of impulse, cognitive flexibility compared with control group through trail making test. This result has been demonstrated in number of studies. (chelun GJ et al, 1981; S.J.C davies et al, 2005; sarawat et al, 2006; K.mann et al,1999). In a study by saraswat et al, 2006 on executive functions in alcoholism it was shown that the alcohol dependent group required a significantly longer time to complete both trail making test part A and part. Poor performance on TMT part A suggests impaired visual scanning and psychomotor speed, whereas significant poorer performance between the alcohol dependent group and controls group on TMT part B and part B minus part A indicate impaired cognitive flexibility and set shifting. Even in our study the same findings have been replicated with significant poor performance in both part A and part B among the study group. This adds to the evidence of frontal lobe dysfunction.

Earlier studies focussed on patients whose cognitive deficits were clinically obvious, such as patients with Korsakoff's syndrome or frank alcoholic dementia (Brown et al., 1958), but subsequent studies (Loberg, 1980; Eckhardt and Matarazzo, 1981; Moselhy et al., 2001) showed that performance on the Trail B could be impaired in alcohol dependence

without any clinically obvious neurological deficits. Noel et al. (2001) reported that ‘non-amnesic’ alcohol-dependent subjects were slower on Trails A and B, and similar to our study, greater impairment was seen in completing the Trail B. Noel et al. (2001) found that performance at easier stages of tasks showed little or no impairment of executive functions and as Trail B requires greater levels of flexibility and exploring planning ability compared with Trail A, it appears that Trail B has sufficient complexity compared with Trail A.

This study also tested for any correlation between duration of abstinence and cognitive function in the study group by Pearson’s correlation coefficient. Our results show that as the duration of abstinence increases the performance on mental speed, visual memory and not verbal memory, learning of verbal material and delayed recall of verbal material, delayed recall of logical memory, immediate and delayed recall of complex figure test (visual memory), visual scanning and cognitive flexibility also improves.

According to saraswat et al 2006, there was a significant relationship between the duration of abstinence and part C of stroop test. Studies on cognitive recovery during abstinence are diverse and they give conflicting results with studies demonstrating rapid, complete, partial recovery within

several weeks or months or years. (Kish et al., 1980; Leber et al., 1981; Mann et al., 1999; Tracy and Bates, 1999; Drake et al., 1995; Fein et al., 1990; Reed et al.,1992; Sullivan et al., 2000) There are also studies which show residual or no cognitive impairment after a year or more of abstinence (Brandt et al., 1983; Yohman et al.,1985; Schandler et al., 1996). The impairment of visual memory among alcoholics studied among recently detoxified (one month), intermediate- term abstinent (two years) and long term abstinent (seven years) subjects showed improved memory performance with increased duration of abstinence.

(Reed RJ et al, 1992; Tivis R et al, 1995)

According to certain tests alcoholics exhibited visuo spatial impairment even when corrected for premorbid IQ and education.

(Beatty WW, 1996; Sullivan EV, 2000).

In a study by Leber WR, 1981, it was found that alcoholics in their 3 weeks of abstinence performed significantly lesser than controls in drawing R-OCF after observation similar to our study but no significant difference was found between alcoholics in their 11 weeks of abstinence when compared with controls. It also concludes that some recovery of visuo spatial functioning may occur after 10 weeks of abstinence.

In 1981, leber et al studied learning and memory in controls and 2 groups of alcoholics with 3 weeks and 11 weeks of abstinence respectively and found no significant difference between the 3 groups in verbal learning abilities but short term abstinent alcoholics performed poorly compared to long term abstinents for visuo spatial learning tasks. Similarly ryan et al in 1980 compared short term and long term abstinents with controls for digit substitution test and found that alcoholics performed poorly compared to controls and long term abstinents performed better than short term abstinents though not significantly similar to the findings of our study.

CONCLUSION

1. Abstinent alcohol dependent males perform poorly compared to the controls in mental speed, sustained attention, logical memory, verbal memory, visuo constructive ability and executive functions (planning, speed of processing, cognitive flexibility, verbal working memory).

2. As the duration of dependence increases study group performed significantle better in mental speed, visual working memory, verbal learning and memory, logical memory, visual memory, visual scanning and cognitive flexibility.

LIMITATIONS

1. The role of drugs especially benzodiazepines on cognition have not been considered. The assessment was made by the investigator which introduces the interviewer bias.
2. The sample size is relatively small to generalise the findings in alcohol dependent population.
3. Nutritional deficiency in the study population has not been studied and hence the cognitive impairment due to korsakoff's psychosis cannot be ruled out.
4. Comorbid personality disorders have not been studied and its influence on cognitive functions cannot be ruled out.
5. The history of previous relapses, previous detoxifications have not been studied which has an influence on cognitive functions as per studies.
6. Intelligence tests, tests for verbal fluency and comprehension has not been assessed in this study.

STRENGTHS

1. To our knowledge there are only few Indian studies on cognitive functions in abstinent alcohol dependent males and this study has assessed multiple components of cognitive functions.

2. The study has included age and education matched control group to minimise the possibility of confounding. It has also measured the correlation of duration of abstinence with the cognitive functions which has been extensively studied.

3. It has utilised NIMHANS neuropsychological battery (2004), a validated Indian test to assess cognition.

4. This study may serve as an eye opener in understanding the effects of alcohol on cognition.

FUTURE DIRECTIONS

1. A clearer picture of the cognitive impairment can be given when longitudinal studies are undertaken rather than cross sectional studies.
2. Though the cognition in alcohol dependence has been extensively studied in the past three decades its importance is underestimated clinically. With lots of background information on the effects of cognitive impairment in the treatment and prognosis it becomes essential to assess the cognition in alcohol dependent males to provide them the appropriate treatment.
3. Assessment of cognition also indicates the clinician the need for improvement of cognition in patients with cognitive impairment even in patients who have normal cognition clinically.
4. Use of Wisconsin card sorting test will give a better picture of thr executive functions.

BIBLIOGRAPHY

1.Adalsteinsson, e.; sullivan, e.v.; and pfefferbaum, a. Biochemical, functional and microstructural magnetic resonance imaging (MRI). In Liu, Y., and Lovinger, D.M., Eds.Methods in AlcoholRelated Neuroscience Research. Boca Raton, FL: CRC Press, 2002, pp. 345–372.

2.Adams KM, Gilman S, Koeppe RA, Kluin KJ, Brunberg JA, Dede D, Berent S, Kroll PD (1993) Neuropsychological deficits are correlated with frontal hypometabolism in positron emission tomography studies of older alcoholic patients. Alcohol Clin Exp Res 17:205–210.

3.Agartz, I., Momenan, R., Rawlings, R. R. et al. (1999) Hippocampal volume in patients with alcohol dependence. Archives of General Psychiatry 56, 356–363.

4.Allen RP, Faillace LA, Wagman A: Recovery time for alcoholics after prolonged alcohol intoxication. Johns Hopkins Med J 1971; 128:158-164

5.Anna kokkavec and simon f. Crowe: A comparison of cognitive performance in binge versus regular chronic alcohol misusers, alchol and alcoholism, vol.34, No. 4, pp- 601 – 608,1999.

6. Antonio verdejo-garcía,1 antoine bechara,2,3 emily c. Recknor,3and miguel pérez-garcía1; Executive dysfunction in substance dependent individuals during drug use and abstinence: An examination of the behavioral, cognitive and emotional correlates of addiction; Journal of the International Neuropsychological Society (2006), 12, 405–415.

7.Arria, A. M. and Van Thiel, D. H. (1992) The epidemiology of alco- hol related chronic disease. Alcohol, Health and Research World 16, 209–216.

8.Arthur W. Blume, M.A.*.; J. Mark Davis, Ph.D.** & Karen B. Schmaling, Ph.D; Neurocognitive Dysfunction in Dually-Diagnosed Patients:A Potential Roadblock to Motivating Behavior Change; Volume 31 (2), April – June 1999

9.Beatty WW, Tivis R, Stott HD, Nixon SJ, Parsons OA (2000) Neuropsy- chological deficits in sober alcoholics: influences of chronicity and

10.Becker JT, Butters N, Hermann A, et al: A comparison of the effects of longterm alcohol abuse and aging on the performance of verbal and nonverbal divided attention tasks. Alcoholism (NY) 1983; 7:213-219

11.Benton, A. L. and Hamsher, K.de S. (1976) Multilingual Aphasia Examination. Iowa City, University of Iowa. (Manual Revised,1978)

12.Bloomer, c.w.; langleben, d.d.; and meyerhoff, D.J.Magnetic resonance detects brainstem changes in chronic, active heavy drinkers. Psychiatry Research 132:209–218, 2004

13.Bowden, S. C. and McCarter, R. J. (1993) Spatial memory in alcohol-dependent subjects: using a push-button maze to test the principle of equiavailability. Brain and Cognition 22, 51–62.

14.Brandt J, Butters N, Ryan C, et al: Cognitive loss and recovery in long-term alcohol abusers. Arch Gen Psychiatry 1983; 40:435-442

15.Brown, E. C., Casey, A., Fisch, R. I. et al. (1958) Trail making test as a screening advice for detection of brain damage. Journal of Consulting Psychology 22, 469–473.

16.Mabuchi T, Kitagawa K, Kuwabara K et al. (2001) Phosphorylation of cAMP response element-binding protein in hippocampal neurons as a protective response after exposure to glutamate in vitro and ischemia in vivo. J Neurosci 21:9204–13.

17.Chandler LJ, Newsom H, Sumners C et al. (1993a) Chronic ethanol exposure potentiates NMDA excitotoxicity in cerebral cortical neurons. J Neurochem 60:1578–81.

18.Chandler LJ, Sumners C, Crews FT. (1993b) Ethanol inhibits NMDA receptor-mediated excitotoxicity in rat primary neuronal cultures.

Alcohol Clin Exp Res 17:54–60.

19. Chanraud, s.; reynaud,m.;wessa,m.; et al. Diffusion tensor tractography in mesencephalic bundles: Relation to mental flexibility in detoxified alcohol dependent subjects. Neuropsychopharmacology 2009, Epub ahead of print July 9, 2008. P

20. Chanraud, S.;Martelli, C.; Delain, F.; ET AL. Brain morphometry and cognitive performance in detoxified alcohol dependents with preserved psychosocial functioning. Neuropsychopharmacology 32:429–438, 2007. PMID: 17047671

21. Chelune GJ, Parker JB: Neuropsychological deficits associated with chronic alcohol abuse. Clin Psychol Rev 1981; 1:181-195

22. Clarke J, Haughton H: A study of intellectual impairment and recovery rates in heavy drinkers in Ireland. Br J Psychiatry 1975; 12:178-184

23. Claudia Bartels et. al;Recovery Of Hippocampus-Related Functions In Chronic Alcoholics During Monitored Long-Term Abstinence; Alcohol & Alcoholism Vol. 42, No. 2, pp. 92–102, 2007

24. D, Cardenas V, Chao LL, Rothlind J, Studholme C, Weiner MW. Effects of heavy drinking binge drinking, and family history of alcoholism on regional brain metabolites. Alcohol Clin Exp Res 2004;28:650–661.

25. Dao-Castellana MH, Samson Y, Legault F, Martinot JL, Aubin HJ, Crouzel C, et al. (1998) Frontal dysfunction in

neurologically normal chronic alcoholic subjects: metabolic and neuropsychological findings. Psychol Med.

26.Davies SJ, Pandit SA, Feeney A et al. (2005) Is there cognitive impairment in clinically 'healthy' abstinent alcohol dependence? Alcohol Alcohol 40:498–503.

27.Demir B, Ulug B, Lay Ergun E, Erbas B (2002) Regional cerebral blood flow and neuropsychological functioning in early and late onset alcoholism. Psychiatry Res 115:115–125.

28.Donovan DM, Kivlahan DR, Walker RD (1984) Clinical limitations of neuropsychological testing in predicting treatment outcome among al- coholics. Alcohol Clin Exp Res 8:470 – 475.

29.Drummond, D. C. (1990) The relationship Between alcohol dependence and alcohol-related problems in a clinical population. British Journal of Addiction 85, 357–366.

30.Durazzo TC, Gazdzinski S, Meyerhoff DJ. (2007) The neurobiological and neurocognitive consequences of chronic cigarette smoking in alcohol use disorders. Alcohol Alcohol 42:174–85.

31.Durazzo TC, Rothlind JC, Gazdzinski S et al. (2006) A comparison of neurocognitive function in non-smoking and chronically smoking short-term abstinent alcoholics. Alcohol 39:1–11.

32.Eckardt MJ, Parker ES, Noble EP, Pautler CP, Gottschalk LA

(1979) Changes in neuropsychological performance during treatment for alco- holism. Biol Psychiatry 14:943–954.

33. Eckardt MJ, Stapleton JM, Rawlings RR, Davis EZ, Grodin DM (1995) Neuropsychological functioning in detoxified alcoholics between 18 and 35 years of age. Am J Psychiatry 152:45–52.

34. Eckhardt, M. J. and Matarazzo, J. D. (1981) Test-retest reliability of Halstead Impairment Index in hospitalised alcoholic and nonalcoholic males with mild to moderate neuropsychological impairment. Journal of Clinical Neuropsychology 3, 257–259.

35. Fein G, Torres J, Price LJ et al. (2006) Cognitive performance in long-term abstinent alcoholic individuals. Alcohol Clin Exp Res 30:1538–44

36. Fein, G., and Landman, B. Treated and treatment naive alcoholics come from different populations. Alcohol 36:19–26, 2005.

37. Fein, G., Bachman, L., Fisher, S. et al. (1990) Cognitive impairments in abstinent alcoholics. The Western Journal of Medicine 152,531–7.

38. Fein, G.; Di Sclafani, V.; Cardenas, V.A.; et al. Cortical gray matter loss in treatment naive alcohol dependent individuals. Alcoholism: Clinical and Experimental Research 26:558–564, 2002.

39. Fein, G.; Landman, B.; Tran,H.; et al. Brain atrophy in long term abstinent alcoholics who demonstrate impairment on a simulated gambling task. NeuroImage 32:1465–1471, 2006.

40.Fitzhugh LC, Fitzhugh KB, Reitan RM: Adaptive abilities and intellectual functioning in hospitalized alcoholics. Q J Stud Alcohol 1960; 21:414-423

41. Frank Norton & Lavania Halay; The American Association of Behavioral and Social Sciences Journal (The AABSS Journal, 2011, Volume 15)

42.Glenn SW, Parsons OA, Sinha R et al. (1988) The effects of repeated withdrawals from alcohol on the memory of male and female alcoholics. Alcohol Alcohol 23:337–42.

43.Goldman MS, Williams DL, Klisz DK: Recoverability of psychological functioning following alcohol abuse: Prolonged visual-spatial dysfunction in older alcoholics.J Consult Clin Psychol 1983; 51:370-378

44.Grant I, Adams KM, Reed R: Aging, abstinence, and medical risk factors in the prediction of neuropsychologic deficit among long-term alcoholics. Arch Gen Psychiatry 1984; 41:710-718

45.Harper C, Kril J. (1989) Patterns of neuronal loss in the cerebral cortex in chronic alcoholic patients. J Neurol Sci 92:81–9.

46.HARPER, C. The neuropathology of alcohol specific brain damage, or does alcohol damage the brain? Journal of Neuropathology and Experimental Neurology 57:101–110, 1998.

47.Harper, C.G., AND Kril, J.J. Neuropathological changes in alcoholics. InHunt W.A., and Nixon, S.J., Eds. Alcohol Induced Brain Damage. NIAAA ResearchMonograph No. 22, Rockville, MD: National Institutes of Health, 1993, pp, 39–69.

48.Harper, C.G., AND Kril, J.J. Neuropathology of alcoholism. Alcohol and Alcoholism 25:207–216, 1990

49.Ihara H, Berrios GE, London M (2000) Group and case study of the dysexecutive syndrome in alcoholism without amnesia. J Neurol Neu- rosurg Psychiatry 68:731–737.

50.Impairment of Cognitive Abilities and Decision Making after Chronic Use of Alcohol: The Impact of Multiple Detoxifications in Patients With Chronic Alcoholism in Contrast to Patients With Korsakoff's Syndrome; J Neuropsychiatry Clin Neurosci 12:1, Winter 2000

51. Isolde Daig, Richard Mahlberg, Julia Stethin, Franziska Schroeder, Jana Wrase,Nina Knoll, Tom Bschor, Guenter Esser, Andreas Heinz, Thorsten Kienast; Decreased Verbal Learning but not Recognition Performance in Alcohol-dependent Individuals During Early Abstinence; Ir J Psych Med 2012; 29 (2): 96-101

52. Isolde Daig1et. al; Low effective organizational strategies in visual memory performance of unmedicated alcoholics during early

abstinence; GMS Psycho-Social-Medicine 2010, Vol. 7, ISSN 1860-5214

53. J.K. Trivedi: cognitive deficits in psychiatric disorders- current status, Indian journal of psychiatry, 2006; 48:10-20.

54. Karl Mann*, Arthur Gunther, Friedhelm Stetter And Klaus Ackermann; Rapid recovery from cognitive deficits in abstinent alcoholics: A controlled test-retest study; Alcohol and Alcoholism Vol. 34, No. 4, pp. 567-574, 1999.

55.Katherine Tzambazis And Con Stough: alcohol impairs speed of information processing and simple And choice reaction time and differentially impairs Higher-order cognitive abilities, *Alcohol & Alcoholism* Vol. 35, No. 2, pp. 197–201, 2000

56.Kleinknecht RA, Goldstein SG: Neuropsychological deficits associated with alcoholism: A review and discussion. Q J Stud Alcohol 1972; 33:999-1019

57.Kopelman, M. D. (1995) The Korsakoff Syndrome. British Journal of Psychiatry 166, 154–173.

58.Kubota,m.; nakazaki, s.;hirai, s.; et al. Alcohol consumption and frontal lobe shrinkage: Study of 1432 non-alcoholic subjects. Journal of Neurology, Neurosurgery, and Psychiatry 71:104–106, 2001.

59.Leber, W. R., Jenkins, R. L. and Parsons, O. A. (1981) Recovery of visual-spatial learning and memory in chronic alcoholics. Journal of

Clinical Psychology 37, 192–197.

60.Leber, W. R., Parsons, O. A. and Nichols, N. (1985) Neuropsychological test results are related to ratings of men alcoholics' thera-peutic progress: a replicated study. Journal of Studies on Alcohol 46(2), 116–121.

61.Lezak,M.D. Neuropsychological Assessment. 3rd ed. New York: Oxford University Press, 1995.

62.Lilijana Šprah, Tatjana Novak; NEUROCOGNITIVE ASSESSMENT OF ALCOHOL INPATIENTS DURING RECOVERY FROM ALCOHOLISM; Zdrav Vestn 2008; 77: II-75–84

63.LUberg T, Miller WR: Personality, cognitive, and neuropsychological correlates of harmful alcohol consumption: A cross-national comparison of clinical samples.Ann NY Acad Sci 1986; 472:75-97

64.J. Rosenbloom, and Adolf Pfefferbaum, M.D;Magnetic Resonance Imaging Of The Living Brain**;** Vol. 31, No. 4, 2008

65.Mann K, Gunther A, Stetter F, Ackermann K (1999) Rapid recovery from cognitive deficits in abstinent alcoholics: a controlled test-retest study. Alcohol Alcohol 34:567–574.

66.Mantamadiotis T, Lemberger T, Bleckmann SC et al. (2002) Disrup-Margaret J. Rosenbloom, and Adolf Pfefferbaum, M.D

67.Mechanisms of Neurodegeneration and Regeneration in Alcoholism Alvarez-Buylla A, Garcia-Verdugo JM.

(2002) Neurogenesis in adult subventricular zone. J Neurosci 22:629–34.

68. Mega, M.S. & Cummings, J.L. 1994. Frontal-sub cortical circuits and neuropsychiatric illness. Journal of Neuropsychiatry & Clinical Neurosciences 6:358-70.

69. Meyerhoff, D.J. Brain spectroscopic imaging, morphometry, and cognition in social drinkers and recovering alcoholics. Alcoholism: Clinical and Experimental Research 29:153–154, 2005.

70. Moselhy, H.F.; Georgiou, G.; AND Kahn, A. Frontal lobe changes in alcoholism: A review of the literature. Alcohol and Alcoholism 36:357–368, 2001.

71. Munro, C. A., Saxton, J. and Butters, M. A. (2000) The neuropsycho-

72. Neuropsychological rehabilitation in alcoholics- a preminary report:grace mathai, shobini l. Rao & p.s. gopinath: Indian journal of psychiatry, 1998, 40(3), 280-288

73. Nirmal Saraswat, Sanjeev Ranja, Daya Ram; Set-shifting and selective attentional impairment in alcoholish and its relation with drinking variables; Indian Journal of psychiatry 2006;48:47-51.

74. Nixon, k., and crews, f.t. Temporally specific burst in cell proliferation increases hippocampal neurogenesis in protracted abstinence from alcohol. Journal of Neuroscience 24:9714–9722, 2004.

75.Nixon, S.J. Application of theoretical models to the study of alcohol induced brain damage. InHunt,W., and Nixon, S.J., Eds. Alcohol Induced Brain Damage. NIAAAMonograph 22. Rockville, MD: National Institutes of Health, 1993, pp. 213–228.

76.Noel X, Van der Linden M, Schmidt N, Sferrazza R, Hanak C, Le Bon O, et al. (2001) Supervisory attentional system in nonamnesic alcoholic men. Arch Gen Psychiatry 58:1152–1158.

77.Noel, X., Van der Linden, M., Schmidt, N. et al. (2001) Supervisory attentional system in nonamnesic alcoholic men. Archives of General Psychiatry 58, 1152–1158.

78.O'neill, j.; cardenas, v.a.; andmeyerhoff, D.J. Effects of abstinence on the brain: Quantitative magnetic resonance imaging and magnetic resonance spectroscopic imaging in chronic alcohol abuse. Alcoholism: Clinical and Experimental Research 25:1673–1682, 2001.
of equiavailability. Brain and Cognition 22, 51–62.

79.Oscarberman, M. Neuropsychological vulnerabilities in chronic alcoholism. In Noronha, A., Eckardt, M.,Warren, K., Eds. Review of NIAAA's Neuroscience and Behavioral Research Portfolio. NIAAA Research Monograph no. 34. Bethesda, MD: National Institutes of Health, 2000, pp. 437–472.

80.Oscarberman,m., andmarinkovic, K. Alcohol: Effects on neurobehavioral functions and the brain. Neuropsychology Review 17:239–257, 2007.

81.P.K. Dalal, T. Sivakumar: Cognitive psychiatry in India, Indian Journal of psychiatry; 52, Supplement, Jan 2010.

82.Page RD, Linden JD: 'Reversible' organic brain syndrome in alcoholics during abstinence-A psychometric evaluation. Q J Stud Alcohol 1974; 35:98-107

83.Parsons OA (1983) Cognitive dysfunction and recovery in alcoholics. Subst Alcohol Actions Misuse 4:175–190.

84.Parsons OA (1986) Alcoholics' neuropsychological impairment: current findings and conclusions. Ann Behav Med 8:13–19.

85.Parsons OA, Nixon SJ. Neurobehavioral sequelae of alcoholism. Neurol Clin 1993;11:205–218. [PubMed: 8441371]

86.Parsons OA. (1987) Intellectual impairment in alcoholics: persistent issues. Acta Med Scand 717(Suppl) 33–46.

87.Parsons, O. A. (1977) Psychological deficits in alcoholics: facts and fancies. Alcoholism: Clinical and Experimental Research 1,51–56.

88.Parsons, O. A., Schaeffer, K. W. and Glenn, S. W. (1990) Does neuropsychological test performance predict resumption of drinking in posttreatment alcoholics? Addictive Behaviours 15, 297–

307.

89. Pfefferbaum, A., Rosenbloom, M., Crusan, K. et al. (1988) Brain CT changes in alcoholics: effects of age and alcohol consumption. Alcoholism: Clinical and Experimental Research 12, 81–87.

90. Pfefferbaum, a., and sullivan, E.V. Diffusion MR imaging in neuropsychiatry and aging. In Gillard, J.;Waldman, A.; and Barker, P., Eds. ClinicalMR Neuroimaging: Diffusion, Perfusion and Spectroscopy. Cambridge: Cambridge University Press, 2005, pp. 558–578.

91. Pfefferbaum, a., and sullivan, E.V. Microstructural but not macrostructural disruption of white matter in women with chronic alcoholism. NeuroImage 15:708–718, 2002.

92. Pfefferbaum, A.; Adalsteinsson, E.; and Sullivan, E.V. Dysmorphology and micro structural degradation of the corpus callosum: Interaction of age and alcoholism. Neurobiology of Aging 27:994–1009, 2006b.

93. Pfefferbaum, A.; Adalsteinsson, E.; BELL, R.L.; AND SULLIVAN, E.V. Development and resolution of brain lesions caused by pyrithiamineand dietary induced thiamine deficiency and alcohol exposure in the alcohol preferring rat: A longitudinal magnetic resonance imaging and spectroscopy study. Neuropsychopharmacology 32:1159–1177, 2007.

94. Pfefferbaum, A.; Adalsteinsson, E.; SOOD, R.; ET AL. Longitudinal brain magnetic resonance imaging study of the alcohol preferring rat: Part II: Effects of voluntary chronic alcohol consumption. Alcoholism: Clinical and Experimental Research 30:1248–1261, 2006a.

95. Pfefferbaum, A.; Desmond, J.E.; Galloway, C.; ET AL. Reorganization of frontal systems used by alcoholics for spatial working memory: An fMRI study. NeuroImage 14:7–20, 2001.

96. Pfefferbaum, A.; LIM, K.O.; Zipursky, R.B.; ET AL. Brain gray and white matter volume loss accelerates with aging in chronic alcoholics: A quantitativeMRI study. Alcoholism: Clinical and Experimental Research 16:1078–1089, 1992

97. Pfefferbaum, A.; Rosenbloom,M.J.; Rohlfing, T.; AND Sullivan, E.V. Degradation of selective lateral and interhemispheric white matter systems in alcoholism detected with quantitative fiber tracking. Biological Psychiatry, 2008. In press.

98. Pfefferbaum, A.; Sullivan, E.V.; Mathalon, D.H.; ET AL. Longitudinal changes in magnetic resonance imaging brain volumes in abstinent and relapsed alcoholics. Alcoholism: Clinical and Experimental Research 19:1177–1191, 1995.

99. Pfefferbaum, A.; Sullivan, E.V.; Rosenbloom, M.J.; ET AL. A controlled study of cortical gray matter and ventricular changes in

alcoholic men over a fiveyear interval. Archives of General Psychiatry 55:905–912, 1998.

100.Pfefferbaum, A.; Sullivan, E.V.;Hedehus,M.; ET AL. In vivo detection and functional correlates of white matter microstructural disruption in chronic alcoholism. Alcoholism: Clinical and Experimental Research 24:1214–1221, 2000.

101.Pfefferbaum, A.; Sullivan, E.V.;Mathalon, D.H.; AND LIM, K.O. Frontal lobe volume loss observed with magnetic resonance imaging in older chronic alcoholics. Alcoholism: Clinical and Experimental Research 21:521–529, 1997.

102.Pfefferbaum, A.; Zahr, N.M.; Mayer, D.; ET AL. Ventricular expansion in wildtypeWistar rats after alcohol exposure by vapor chamber. Alcoholism: Clinical and Experimental Research 32:1459–1467, 2008. ,pp. 217–242.

103.Ratti MT, Bo P, Giardini A, Soragna D (2002) Chronic alcoholism and the frontal lobe: which executive functions are impaired? Acta Neurol Scand 105:276–281.

104.Ratti, M. T., Soragna, D., Sibilla, L. et al. (1999) Cognitive impairment and cerebral atrophy in 'heavy drinkers'. Progress in Neuropsychopharmacology and Biological Psychiatry 23, 243–258.

105.Rosenbloom MJ, Rohlfing T, O'Reilly AW et al. (2007) Improvement in memory and static balance with abstinence in alcoholic men and women: selective relations with change in brain structure.Psychiatry Res 155:91–102.

106.Rosenbloom, m.j.; rohlfing, T.; O'reilly, A.W.; ET AL. Improvement in memory and static balance with abstinence in alcoholic men and women: Selective relations with change in brain structure. Psychiatry Research: Neuroimaging 155:91–102, 2007.

107.Rosenbloom,M.J.; Pfefferbaum, A.; AND Sullivan, E.V. Recovery of short term memory and psychomotor speed but not postural stability with long term sobriety in alcoholic women. Neuropsychology 18:589–597, 2004.

108.Rosenbloom,m.j.; rohlfing, t.; o'reilly, a.w.; et al. Improvement in memory and static balance with abstinence in alcoholic men and women: Selective relations with change in brain structure. Psychiatry Research: Neuroimaging 155:91–102, 2007.

109.Rosenbloom,m.j.; sassoon, s.a.; fama, r.; et al. Frontal callosal fiber integrity selectively predicts coordinated psychomotor performance in alcoholism. Brain Imaging and Behavior 2:74–83, 2008.

110.Rosenbloom,m.j.; sullivan, e.v.; and pfefferbaum, a. Using magnetic resonance imaging and diffusion tensor imaging to assess brain damage

in alcoholics. Alcohol Research & Health 27:146–152, 2003. PMID: 15303625

111.Rourke SB, Grant I (1999) The interactive effects of age and length of abstinence on the recovery of neuropsychological functioning in chronic male alcoholics: a 2-year follow-up study. J Int Neuropsychol Soc 5:234–246.

112.Rourke SB, Loberg T (1996) Neurobehavioral correlates of alcoholism, in Neuropsychological Assessment of Neuropsychiatric Disorders (Grant I, Adams KM eds), 2nd ed, pp 423–485. Oxford University Press, New York.

113.Ryan C, Butters N: Cognitive deficits in alcoholics, chap 12, In Kissin B,Begleiter H (Eds): The Pathogenesis of Alcoholism-Vol 7, Biological Factors. New York, Plenum Press, 1983, pp 485-538

114.Ryan C: Learning and memory deficits in alcoholics. J Stud Alcohol 1980; 41:437-447

115. Sabine Loeber*, Theodora Duka, HelgaWelzel Márquez, Helmut Nakovics , Andreas Heinz, Karl Mann and Herta Flor; Effects of Repeated Withdrawal from Alcohol on Recovery of Cognitive Impairment under Abstinence and Rate of Relapse; Alcohol and Alcoholism Vol. 45, No. 6, pp. 541–547, 2010

116.Sandra Zinn, Roy Stein, and H. Scott Swartzwelder: Executive Functioning Early in Abstinence From Alcohol: alcoholism-

vol.28,no.9,2004

117.Shear, p.k.; butters, n.; jernigan, t.l.; ET AL. Olfactory loss in alcoholics: Correlations with cortical and subcorticalMRI indices. Alcohol 9:247–255, 1992.

118.Simon j. C. Davies1, smita a. Pandit1, adrian feeney1, brian j. Stevenson1, robert w. Kerwin2, david j. Nutt1, e. Jane marshall3, stephen boddington4 and anne lingford-hughes1* Is there cognitive impairment in clinically 'healthy' abstinent alcohol dependence?;.Alcohol and alcoholism, vol.40, no.6,pp.498-503,2005

119. Skinner HA, Allen BA. (1982) Alcohol dependence syndrome: measurement and validation. J Abnorm Psychol 91:199–209.

120.Sullivan EV, Pfefferbaum A. (2005) Neurocircuitry in alcoholism: a substrate of disruption and repair. Psychopharmacology

121.Sullivan, E.V. Human brain vulnerability to alcoholism: Evidence from neuroimaging studies. In Noronha, A.; Eckardt,M.; andWarren, K., Eds. Review of NIAAA's Neuroscience and Behavioural Research Portfolio. NIAAA ResearchMonograph no. 34. Bethesda,MD: National Institutes of Health, 2000, pp. 473–508.

122. Sullivan, e.v., and pfefferbaum, A. Neurocircuitry in alcoholism: A substrate of disruption and repair. Psychopharmacology 180:583–594, 2005. PMID: 15834536

123.Sullivan, e.v., and pfefferbaum, A. Neuroimaging of theWernicke Korsakoff syndrome. Alcohol and Alcoholism, 2009. In press.

124.Sullivan, e.v.; deshmukh, a.; de rosa, E.; ET AL. Striatal and forebrain nuclei volumes: Contribution to motor function and working memory deficits in alcoholism. Biological Psychiatry 57:768–776, 2005..

125.Sullivan, e.v.; harding, a.j.; pentney, r.; ET AL. Disruption of frontocerebellar circuitry and function in alcoholism. Alcoholism: Clinical and Experimental Research 27:301–309, 2003a.

126.Sullivan, e.v.; lane, b.; deshmukh, a.; et al. In vivo mammillary body volume deficits in amnesic and nonamnesic alcoholics. Alcoholism: Clinical and Experimental Research 23:1629–1636, 1999. PMID: 10549995

127.Sullivan, e.v.; marsh, l.;mathalon, D.H.; ET AL. Relationship between alcohol withdrawal seizures and temporal lobe white matter volume deficits. Alcoholism: Clinical and Experimental Research; 20:348–354, 1996.

128.Sullivan, e.v.; Rosenbloom, m.j.; and Pfefferbaum, A. Pattern of motor and cognitive deficits in detoxified alcoholic men. Alcoholism: Clinical and Experimental Research 24:611–621, 2000c. PMID: 10832902

129.Sullivan, e.v.; rosenbloom,m.j.; lim, k.o.; and pfefferbaum, a. Longitudinal changes in cognition, gait, and balance in abstinent and

relapsed alcoholic men: Relationships to changes in brain structure. Neuropsychology 14:178–188, 2000b. PMID: 10791858

130.Tarter RE, Jones B: Motor impairment in chronic alcoholics. Dis Nerv Syst 1971; 32:632-636

131.Unkenstein AE, Bowden SC (1991) Predicting the course of neuropsy- chological status in recently abstinent alcoholics: a pilot study. Clin Neuropsychol 5:24–32.

132.Walton MR, Dragunow I. (2000) Is CREB a key to neuronal survival?

133.Weingartner H, Faillace LA, Markley HG: Verbal information retention in alcoholics. Q J Stud Alcohol 1971; 32:293-303

134.Yohman, J. R., Parsons, O. A. and Leber, W. R. (1985) Lack of recovery in male alcoholics' neuropsychological performance one year after treatment. Alcoholism: Clinical and Experimental Research 9, 114–117.

APPENDIX

SERIAL NO:

O.P. NO :
I.P. NO :

IDENTIFICATION DETAILS

NAME : AGE :

EDUCATION : OCCUPATION :

RELIGION : INCOME :

ADDRESS : PHONE NO :

HISTORY DETAILS :

DURATION OF ALCOHOL DEPENDENCE :

DURATION OF ABSTINENCE :

ANY WITHDRAWAL SYMPTOMS :

ANY PSYCHOTIC SYMPTOMS :

COMPLETED DETOXIFICATION ?

HISTORY OF HEAD INJURY ?

ANY NEUROLOGICAL ILLNESS ?

ANY MEDICAL ILLNESS ?

MEDICATIONS :

ANY OTHER DRUG ABOSE / DEPENDENCE :

ANY PREVIOUS PSYCHIATRIC ILLNESS :

DIGIT SYMBOL SUBSTITUTION TEST

1	2	3	4	5	6	7	8	9
—	⊥	⊐	L	U	O	∧	X	=

2	1	3	7	2	4	8	1	5	4	2	1	3	2	1	4	2	3	5	2	3	1	4	6	3

1	5	4	2	7	6	3	5	7	2	8	5	4	6	3	7	2	8	1	9	5	8	4	7	3

6	2	5	1	9	2	8	3	7	4	6	5	9	4	8	3	7	2	6	1	5	4	6	3	7

9	2	8	1	7	9	4	6	8	5	9	7	1	8	5	2	9	4	8	6	3	7	9	8	6

Appendix

AUDITORY – VERBAL LEARNING TEST

DATE:

English Version

S.No.	LIST - A	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	LIST B	IR-A	DR- A	Recognition
1	Arm (கை)						Shoes			Hits
2	Cat பூனை						Monkey குரங்கு			Mirror கண்ணாடி Hammer சுத்தி
3	Axe கோபாரி						Bowl கோப்பை			Knife கத்தி Candle மெழுகுதிரி
4	Bed மெத்தை						Cow பசு			Motorcycle மோட்டார்சைக்கிள் Axe கோடாரி
5	Plane						Finger விரல்			Clock கடிகாரம் Chair நாற்காலி
6	Ear காது						Dress அங்கி			Plane பிளேன் Turtle ஆமை
7	Dog நாய்						Spider சிலந்தி			Leg கால் Dog நாய்
8	Hammer சுத்தி						Cup			Table மேஜை Cat பூனை
9	Chair நாற்காலி						Bee தேனீ			Lips உதடு Tree மரம்
10	Car						Foot கால்			Arm முழங்கை Nose மூக்கு
11	Eye கண்						Hat தொப்பி			Sun சூரியன் Truck Truck
12	Horse குதிரை						Butterfly பட்டாம்பூச்சி			Eye கண் Fish மீன்
13	Knife கத்தி						Kettle			Ear காது Horse குதிரை
14	Clock கடிகாரம்						Mouse எலி			Bike மிதிவண்டி Stool மலம்
15	Bike						Hand கை		—	Bus பஸ் Bed மெத்தை
										Car கார்

TOTAL SCORES

TRIAL 1	TRIAL 2	TRIAL 3	TRIAL 4	TRIAL 5	LIST B	IR- A	DR	RECOGNITION	
								HITS	
								OMMISSION	
								COMMISSION	

DIGIT VIGILANCE TEST

Serial No. Name Age Sex Date

Total Time Errors O C

9	5	3	6	4	7	2	8	1	9	2	8	6	2	4	1	2	4	6	8	9	7	3	5	1	8	6	4	2	9
8	4	2	1	3	5	6	1	9	7	5	6	3	8	2	3	9	7	4	1	2	3	4	5	6	7	8	9	1	2
1	7	4	8	6	3	2	9	7	1	4	3	2	5	9	5	7	8	6	3	4	5	6	1	7	2	8	3	9	4
6	1	3	2	9	4	6	5	8	7	3	1	9	5	1	7	5	9	8	1	7	2	8	3	9	4	1	5	2	6
4	6	7	4	5	3	2	9	1	8	6	4	2	8	6	9	3	1	5	3	1	4	2	5	3	6	4	7	5	8
2	3	8	2	6	9	7	4	9	1	3	8	6	9	2	2	1	3	8	6	3	7	4	8	5	9	6	1	7	2
5	8	9	3	1	7	2	6	8	4	1	3	5	7	9	4	8	2	9	4	8	5	9	6	1	7	2	8	3	9
3	9	1	4	2	6	8	7	5	1	3	2	4	6	8	6	6	4	1	1	8	5	2	9	6	3	1	7	4	2
6	2	3	5	7	9	1	4	8	2	4	1	3	7	9	8	2	5	2	9	3	1	7	4	2	5	7	6	3	5
9	2	5	6	1	3	7	2	4	6	1	7	8	3	5	9	4	6	3	1	8	5	2	9	6	3	1	4	2	7
8	3	7	8	2	6	4	9	1	5	7	2	4	6	8	7	5	8	4	6	9	1	4	7	1	2	5	8	4	3
7	4	9	7	1	3	5	2	4	6	9	8	1	3	7	5	7	9	6	1	6	3	8	4	9	5	1	6	2	7
4	5	2	9	2	1	3	7	9	8	4	2	6	8	4	1	3	5	7	3	3	7	8	3	9	4	1	5	2	6	7
2	6	4	1	9	4	3	5	7	1	4	7	3	1	4	1	3	9	5	7	8	1	6	2	7	3	8	4	9	5
5	7	6	3	1	9	6	5	6	3	5	8	6	2	5	8	1	7	9	5	9	2	4	6	8	1	3	5	7	9
3	8	2	5	6	4	2	8	7	2	6	9	7	3	8	6	2	8	7	9	1	2	3	5	3	9	1	7	3	4
2	9	8	7	1	3	5	7	9	8	4	2	6	9	7	4	8	6	1	2	3	4	5	7	8	4	6	2	8	9
1	7	4	9	5	6	8	3	2	1	3	5	7	8	2	2	6	5	3	4	2	6	7	9	4	1	2	8	4	5
6	5	8	2	1	3	9	7	4	9	7	5	3	1	8	5	4	3	2	6	4	8	9	2	9	5	7	3	9	1
4	6	3	4	9	2	5	8	2	5	2	8	5	2	3	3	1	4	5	8	5	1	2	4	5	2	3	9	5	6
5	4	5	6	8	1	4	7	1	6	3	9	6	4	5	7	2	1	4	1	6	3	4	6	1	6	8	4	1	2
3	2	7	8	6	9	3	6	1	7	4	1	7	6	7	9	3	2	6	2	7	5	6	8	6	3	4	1	6	7
1	3	9	5	4	8	2	5	2	8	5	2	8	8	9	4	5	1	7	3	8	7	8	1	2	7	9	5	2	3
9	1	8	3	5	7	1	4	3	9	6	3	9	1	2	6	4	2	8	4	1	9	1	2	7	4	5	2	7	8
6	4	2	9	3	6	9	3	4	1	7	4	1	3	4	2	6	3	9	5	2	1	3	4	3	8	1	6	3	4

TRIADS TEST

(1) உருளைக்கிழங்கு
கேரட் – 3
பஸ்

(2) அப்பளம்
அருந்து – 17
அரிசி

(3) திரைப்படம் – 9
நாய்
தக்காளி

(4) காரி – 12
கோபால்
யானை

(5) கண் – 41
காது
மண்டி

(6) சொல்லி – 8
சிமெண்ட்
மனைப்பலகை

(7) ரோஜா – 2
மல்லி
வெங்காயம்

(8) மனம் – 4
பென்சில்
நாடு

(9) கை – 61
கால்
படம்

(10) மீட்டகம் – 33
மூக்கு
மரம்

(11) மேஜை – 7
நாற்காலி
திரைப்படம்

(12) பேப்பர் – 1
புத்தகம்
தாள்

(13) காற்றுக்காலம் – 24
மின்காலம்
பேனா

(14) சிங்கம் – 57
புலி
பூ

(15) மாலை – 5
லாரி
ஓட்டு

(16) அம்மா – 17
மிதிவண்டி
மனம்

LOGICAL MEMORY PASSAGE

Asha Kumári/of South Kánara /employed /as a work woman /in an office building/ reported at the city police /station /that she had been held /up on Bazaar street/ the night before and robbed /of fifteen rupees /she had four /little children the /rent was due/ and they had not eaten /for two days /the officers /touched by the woman's /story /gave some money /to her.

Total facts – 21

ஒரு அழு வலகத்தில் / பணியாளராக / பணி புரியும் (வேலை செய்யும்) / தென்னிலை -யை சேர்ந்த / அசோகமாரி / தகர சாவல் நிலையத்தில் / புகார் கொடுத்தார் / தான் கடைத்தெருவில் / அகப்பட்டதாகவும் / தன் பதினைந்து ரூபாய் / நிதியை இரவில் கொள்ளையடிக்கப் பட்டதாகவும் கூறினார் / தனக்கு நான்கு / சிறு (குட்டி) குழந்தைகள் உள்ளனர் எனவும் / வாடகை பாக்கி உள்ளது எனவும் / குழந்தைகள் இரண்டு நாட்களுக்கு / உண்ணவில்லை எனவும் கூறினார் / அப் பெண்ணின் கதையை / கேட்ட அதிகாரிகள் / மனம் உருகி / அவளுக்கு / பணம் கொடுத்தனர்.

No. of facts in Immediate recall –

No. of facts in Delayed recall – (30min)

No. A nature of confabulation –

Appendix

VERBAL WORKING MEMORY

1 BACK

1	GA	
2	JA	
3	**JA**	
4	CHA	
5	HA	
6	**HA**	
7	SHA	
8	RA	
9	NA	
10	MA	
11	**MA**	
12	KA	
13	PA	
14	**PA**	
15	LA	
16	VA	
17	TA	
18	**TA**	
19	LA	
20	PA	
21	VA	
22	**VA**	
23	DA	
24	**DA**	
25	CHA	
26	SHA	
27	**SHA**	
28	GA	
29	YA	
30	**YA**	

2 BACK

1	NA	
2	GA	
3	**NA**	
4	MA	
5	LA	
6	JA	
7	LA	
8	MA	
9	KA	
10	LA	
11	**KA**	
12	JA	
13	YA	
14	MA	
15	**YA**	
16	DHA	
17	BHA	
18	**DHA**	
19	VA	
20	SHA	
21	**VA**	
22	GA	
23	**YA**	
24	**GA**	
25	DA	
26	NA	
27	**DA**	
28	CHA	
29	RA	
30	MA	

	H	O	C	ERROR (O – C)
1 BACK				
2 BACK				

TOWER OF LONDON

Trials	Start time	Finish time	No of moves
I			
II			
2 M's-I			
II			
3 M's-I			
II			
III			
IV			
4 M's-I			
II			
III			
IV			
5 M's-I			
II			
III			
IV			

MTT	MOM	NPMM

MTT	MOM	NPMM

MTT	MOM	NPMM

MTT	MOM	NPMM

TNPMM = [ ]

(TOTAL NUMBER OF PROBLEMS SOLVED WITH MINIMUM NUMBER OF MOVES) (Including all category)

MTT – MEAN TIME TO SOLVE THE PROBLEM.
(Average time taken to solve the problem for 2moves, 3moves, 4moves, 5 moves separately)

MOM – MEAN NUMBER OF MOVES
(Average number of moves taken to solve 2moves, 3moves, 4moves, 5 moves separately)

NPMM – No. OF PROBLEMS SOLVED WITH MINIMUM NUMBER OF MOVES (Calculated separately for 2moves, 3moves, 4moves,

Appendix

TOWER OF LONDON

II Moves

a) G R B
b) * R G
B

III. Moves

a. B
G R *

b. R B G

c. * G B
R

d. R G *
B

IV Moves

a) G
R B *

b) B G
R *

c) * B
R G

d) B * G
R

V Moves

a) G
B

R * *

b) B
R G *

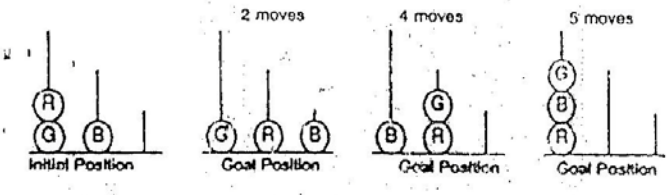
c) B R G

c) B
G
R * *

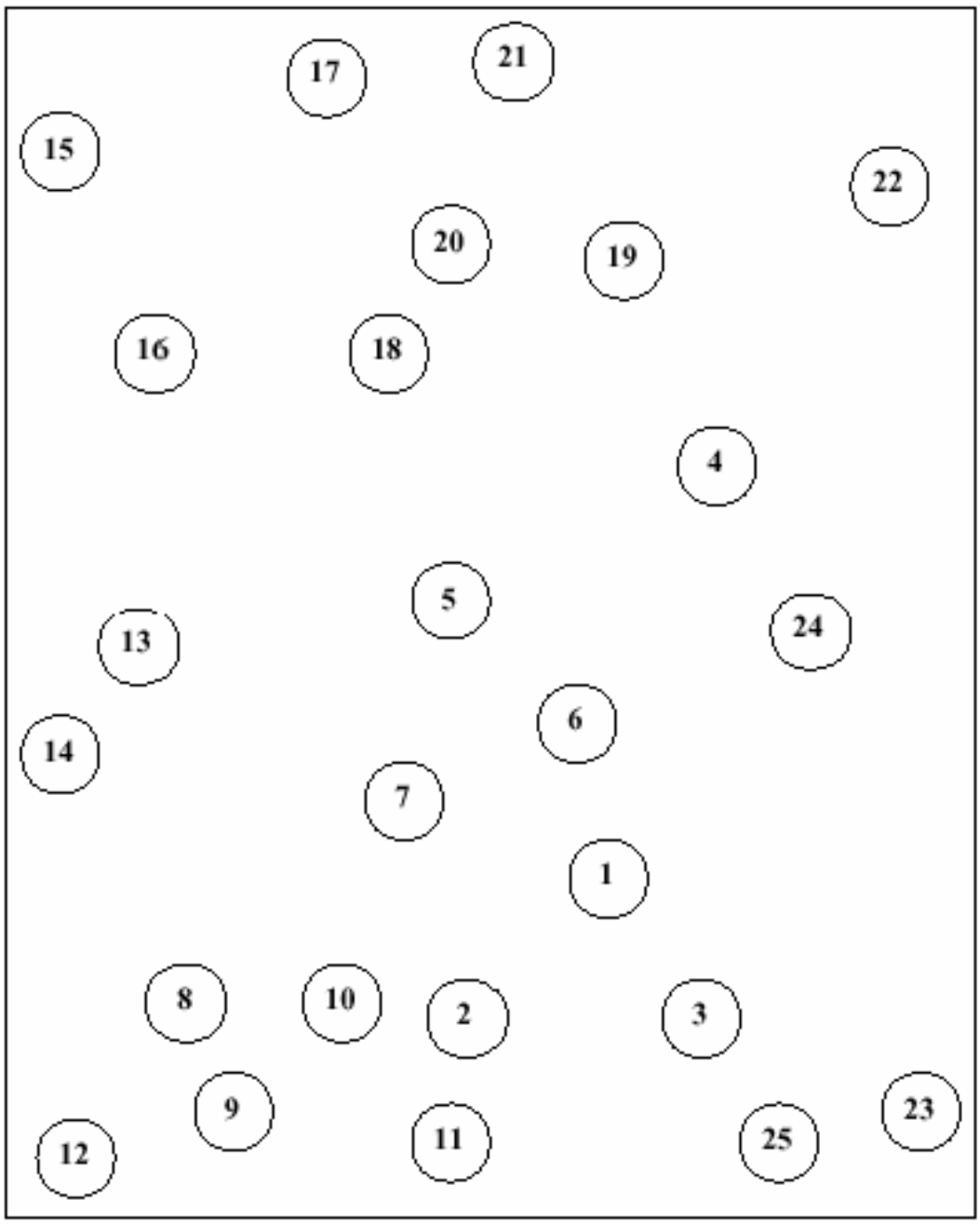
Trials

1) B
G * R

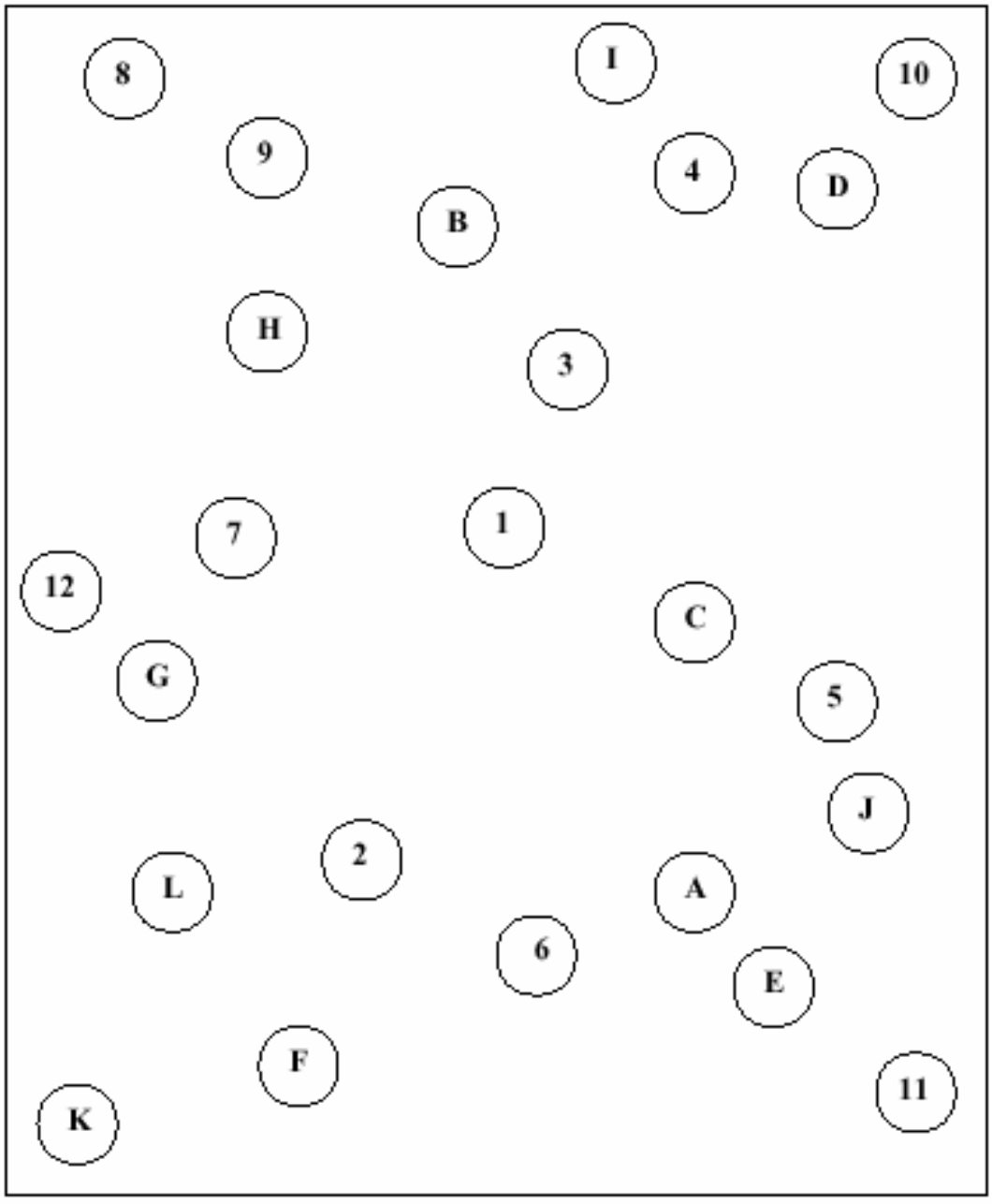
2) G
* B R



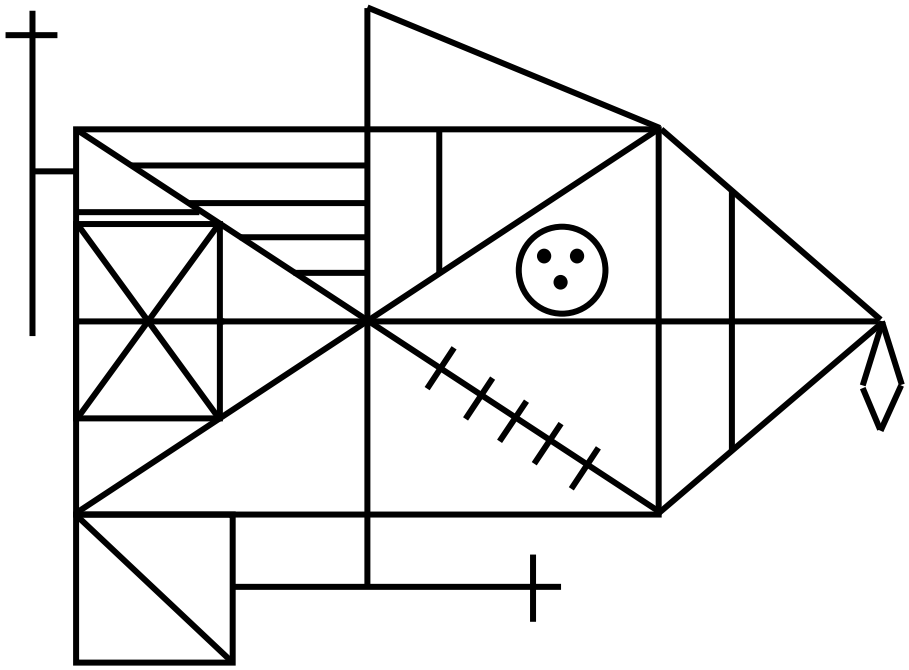
Trail making test- Part A:



Trail Making Test- Part B



Rey-Osterrieth Complex Figure Test:



INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE, CHENNAI -3

Telephone No : 044 25305301
Fax : 044 25363970

CERTIFICATE OF APPROVAL

To
Dr. V. Sujaritha
PG in MD Psychiatric Medicine
Madras Medical College, Chennai -3

Dear Dr. V. Sujaritha

The Institutional Ethics committee of Madras Medical College, reviewed and discussed your application for approval of the proposal entitled "cognitive functions in abstinent alcohol dependent males- a cross sectional study" No.19092012.

The following members of Ethics Committee were present in the meeting held on 13.09.2012 conducted at Madras Medical College, Chennai -3.

1. Dr. S.K. Rajan. M.D.,FRCP.,DSc	-- Chairperson
2. Prof. Pregna B. Dolia MD Vice Principal, Madras Medical College, Chennai -3 Director , Institute of Biochemistry, MMC, Ch-3	-- Member Secretary
3. Prof. B. Vasanthi MD Professor of Pharmacology ,MMC, Ch-3	-- Member
4. Prof. M. Reghu MD Director, Inst. Of Internal Medicine, MMC, Ch-3	-- Member
5. Prof. MD. Ali. MD.DM Prof & HOD of MGE, MMC, Ch-3	-- Member
6. Prof. P. Karkuzhali. MD Director i/c, Prof., Inst. of Pathology, MMC, Ch-3	-- Member
7. Prof. Bavani Shankar. MS Prof of General Surgery, MMC, Ch-3	-- Member
8. Thiru. S. Govindsamy. BABL	-- Lawyer
9. Tmt. Arnold Soulina MA MSW	-- Social Scientist

We approve the proposal to be conducted in its presented form.

Sd/ Chairman & Other Members

The Institutional Ethics Committee expects to be informed about the progress of the study, and SAE occurring in the course of the study, any changes in the protocol and patients information / informed consent and asks to be provided a copy of the final report.

Member Secretary, Ethics Committee

ஆராய்ச்சி ஒப்புதல் கடிதம்

ஆராய்ச்சி தலைப்பு :

பெயர் : தேதி :

வயது : உள் நோயாளி எண் :

பால் : ஆராய்ச்சி சேர்க்கை என் :

இந்த ஆராய்ச்சியின் விவரங்களும் அதன் நோக்கங்களும் முழுமையாக எனக்கு தெளிவாக விளக்கப்பட்டது.

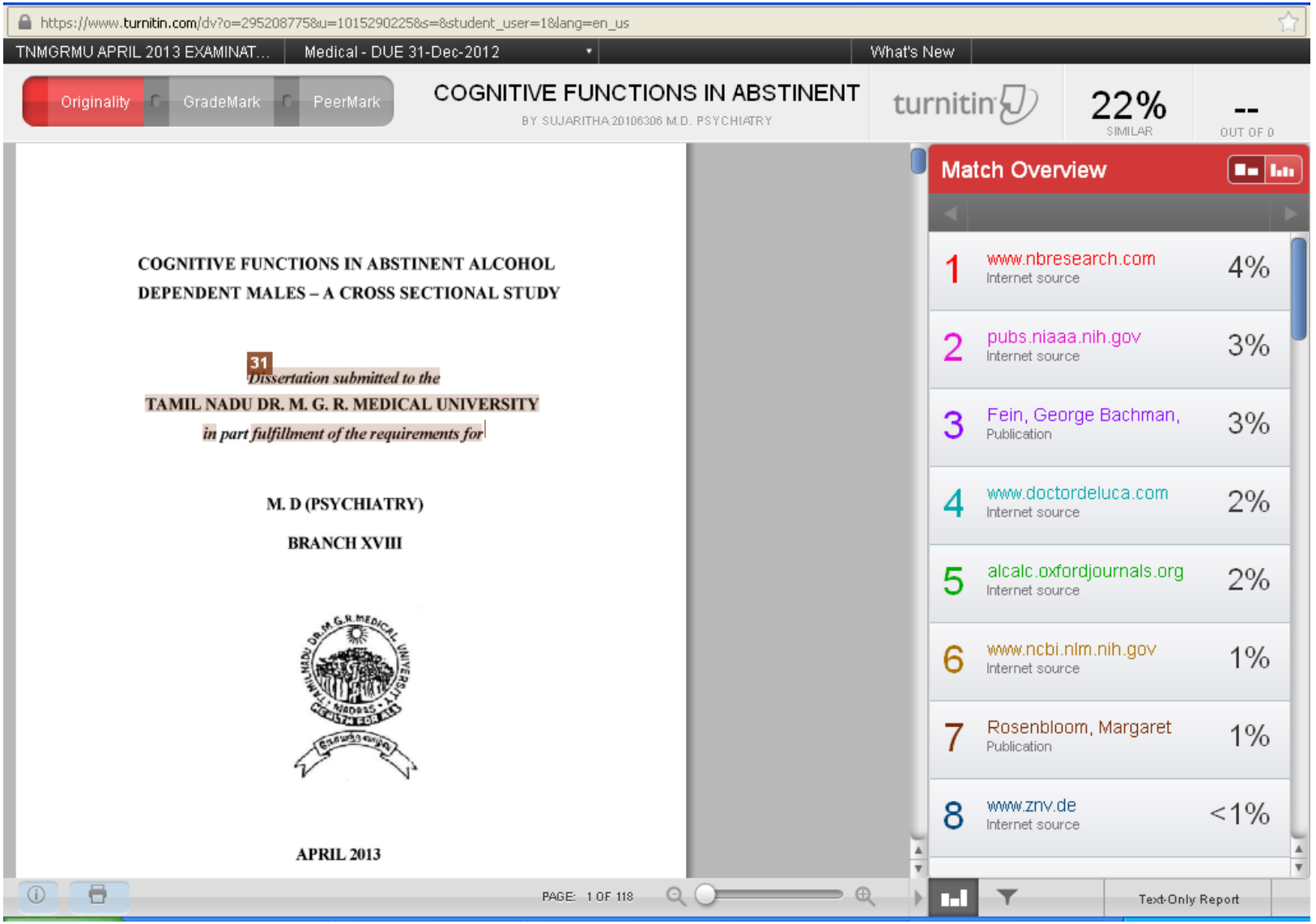
எனக்கு விளக்கப்பட்ட விஷயங்களை நான் புரிந்துகொண்டு நான் எனத சம்மதத்தைத் தெரிவிக்கிறேன்.

இந்த ஆராய்ச்சியில் பிறரின் நிர்ப்பந்தமின்றி என் சொந்த விருப்பத்தின் பேரில் தான் பங்கு பெறுகிறேன் மற்றும் நான் இந்த ஆராய்ச்சியிலிருந்து எந்நேரமும் பின்வாங்கலாம் என்பதையும் அதனால் எந்த பாதிப்பும் ஏற்படாது என்பதையும் நான் புரிந்துகொண்டேன்.

இந்த ஆராய்ச்சியின் விவரங்களைக் கொண்ட மருத்துவ ஆராய்ச்சியில் என்னை சேர்த்துக் கொள்ள சம்மதிக்கிறேன்.

நான் என்னுடைய சுயநினைவுடன் மற்றும் முழு சுதந்திரத்துடன் இந்த மருத்துவ ஆராய்ச்சியில் என்னை சேர்த்துக்கொள்ள சம்மதிக்கிறேன்.

கையொப்பம்


https://www.turnitin.com/dv?o=295208775&u=1015290225&s=&student_user=1&lang=en_us
TNMGRMU APRIL 2013 EXAMINAT...
Medical - DUE 31-Dec-2012
What's New
Originality
GradeMark
PeerMark
COGNITIVE FUNCTIONS IN ABSTINENT
BY SUJARITHA 20106306 M.D. PSYCHIATRY
turnitin
22%
SIMILAR
--
OUT OF 0
COGNITIVE FUNCTIONS IN ABSTINENT ALCOHOL DEPENDENT MALES – A CROSS SECTIONAL STUDY
31
Dissertation submitted to the
TAMIL NADU DR. M. G. R. MEDICAL UNIVERSITY
in part fulfillment of the requirements for
M. D (PSYCHIATRY)
BRANCH XVIII
APRIL 2013
PAGE: 1 OF 118
Match Overview
1 www.nbresearch.com Internet source 4%
2 pubs.niaaa.nih.gov Internet source 3%
3 Fein, George Bachman, Publication 3%
4 www.doctordeluca.com Internet source 2%
5 alcalc.oxfordjournals.org Internet source 2%
6 www.ncbi.nlm.nih.gov Internet source 1%
7 Rosenbloom, Margaret Publication 1%
8 www.znv.de Internet source <1%
Text-Only Report