Article *NIMHANS Journal*

Social Drinking - Part I: Neuropsychological Changes in Social Drinkers

Volume: 14 Issue: 01 January 1996 Page: 15-21

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Reprints request

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Abstract

The aim of the study was to determine if any difference existed in cognitive processing between social drinkers and teetotallers. Twenty-six male social drinkers and equal number of male teetotallers were tested on a battery neuropsychological of tests comprising of Visual and Verbal Learning and Memory Functions, Digit-Symbol Substitution Test, Trail Making Test and Raven's Standard Progressive Matrices. The results indicate a significant disadvantage in the social drinkers compared to the teetotallers on some of the functions involving immediate memory, psychomotor performance and abstract reasoning. No significant association emerged between test scores and drinking variables except trends in regard to correlation between quality of alcohol consumed in the most recent past and test performances.

Key words -

Social drinking,
Teetotallers,
Neuropsychological tests,
Information processing

While many neurological signs and symptoms are part of alcoholism, it is also evident that alcoholics without any obvious neurological or other psychiatric complications may exhibit neuropsychological deficits. Impairment on tests of learning and memory, abstraction, problem-solving, visuospatial skills [1], [2] have been shown in alcohol dependent patients. Evidence has also accumulated to suggest that similar deficits may also be seen in social drinkers (SDs) who are non-dependent regular users of alcohol [3], [4]. It has been found that several factors viz. age, sex, family history of alcoholism, and drinking patterns may influence the test results. Social drinking, as a concept and practice is generally defined as a normal variant. But selection of subjects to form a homogeneous group can be difficult indeed especially in terms of the quantity of alcohol consumed and the frequency of its consumption. This can become a severe problem especially when normal subjects with rather high rate and quantity of alcohol consumption are to be chosen. The present study is an attempt to compare a group of SDs with an age matched control group of Teetotallers (TTs), taking into account as many factors that may influence test performance, as possible.

Material and Methods

The study was conducted on male social drinkers who volunteered to participate in the study. No subject confined himself to the consumption of a particular type of liquor, rather all available forms of alcoholic beverages popularly called as Indian made foreign liquors constituted the drinking repertoire. These included chiefly whisky, rum, brandy, gin, vodka and beer. But there was none who were addicted to other chemicals. Thirty millilitre of a drink at 75% strength (proof) was considered to contain 11.25 ml of alcohol and this multiplied by 0.785, the density of alcohol gave the alcohol content in grams [5]. Normal volunteers were drawn on the basis of the following selection criteria.

Inclusion criteria:

Age: 20-40 years, right handed [6].

Minimum education:

Graduation - either completed or ongoing.

For SDs:

Consumption of not less than 39.25 gms of alcohol per week (the equivalent of 25 ml of ethanol or approximately two 30 ml pegs of 75% proof spirit) on average for at least one year; and the last drink taken not less than three days before testing.

For TTs:

Total consumption of less than the equivalent of 39.25 gms per 6 month period (the equivalent of 50 ml ethanol or approximately four and half 30 ml pegs of 75% proof), commencing from the initial exposure to alcohol; and the last drink not less than 1 month before testing, or those who have never taken alcohol till the time of testing.

Exclusion Criteria:

Past or present diagnosis of alcoholism, past or present neurological or psychiatric illness; significant current medical illness; or current medication for any illness; abuse of any other chemical; family history of substance abuse including alcoholism; and psychoses in the first degree relatives.

These selection criteria were based on putative evidence that specified variables could potentially influence results for eg., male and female alcoholics and SDs have been shown to react differently to alcohol [7]; consumption of alcohol may lead to a carry over effect on neuropsyhcological performance which lasts up to one and a half days later [8]; and information processing profile may be influenced by positive family history of alcoholism [9].

Sample:

26 SDs and 26 TTs were selected for the study. No female subjects were considered as none came forward to being included in the study. The two groups were matched for age and education. The testing was initiated after ascertaining the suitability of the individual for inclusion in the study and obtaining the informed consent.

Neuropsychological assessment:

The neuropsychological battery used in the study consisted of the following tests:

1. Learning and Memory Functions Tests: The tests consisted of two separate scales [4], one in the verbal (auditory) and the other in the visual modality. The verbal test consisted of a complex passage

with logical associations with 42 units of information. The mode of administration was as described by Mukundan et al [10], [11]. The passage was read out in three consecutive trials and the subject was instructed to recall the passage immediately. In the last trial the subject was asked to recall the passage from memory after a delay of ten minutes. Scoring was done in terms of the units of information produced. The visual form of this test consisted of a modified form of the Ray-Ostrich figure with a modified form of administration. The complex figure was shown to the subject for 15 seconds, which was followed by an immediate reproduction. There were three consecutive trials with immediate reproduction, followed by a delayed recall (10 minutes later) from memory and a fifth trial of copying the design.

2. The Trial Making Test [12], the Digit-Symbol Substitution Tests [12], and Raven's Standard Progressive Matrices (RPM) were the other three tests administered. The Trial Making Test was presented on a sheet of paper which had numbers and alphabets, 1 to 26 and A to Z respectively printed randomly. The test has two parts A and B. The subject was to draw lines connecting alphabets and numbers consecutively in serial order. The Digit-Symbol Substitution test consisted of 5 rows of 100 blank squares, and each square paired with randomly assigned number from 1 to 9. The key for substitution of numbers with the symbols was printed on the top. The subject was to print the symbol that is paired with a number in the key, in the empty cell, as fast as possible.

Results

The mean age and education in years of the sample are provided in Table I. No significant mean differences were evident on these measures. Table II gives the drinking characteristics of the SDs. As is apparent, drinking habits varied widely. Tables III and IV present the performance on the verbal and visual learning and memory functions tests respectively. Tables V and VI have the results of the Trail making and the Digit-Symbol Substitution tests respectively. Table VII gives the data on Raven's Progressive Matrices.

Table I - Mean ages and education of the TTs and the SDs

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Table II - Drinking variables in the SD group (n=26)

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Table III - Performance of TTs and SDs on the Verbal Learning and Memory Functions Test

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Table IV - Performance of TTs and SDs on the Visual Learning and Memory Functions Test

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Table V - Performance (in seconds) of TTs and SDs on Trail Making Test- Part A and Part B

Table V - Performance (in seconds) of TTs and SDs on Trail Making Test- Part A and Part B

Table VI - Performance of TTs and SDs on Digit-Symbol Substitution Test

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Table VII - Performance of TTs and SDs on Raven's Progressive Matrices Test

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The data on the learning and memory functions were analyzed using a two-way multiple ANOVA. In order to identify variables which best distinguished SDs and TTs a linear discriminant function analysis was carried out. The percentage of correct classification for the SDs and TTs were 86.4% and 90.9% respectively. The visual learning and memory functions test had the maximum discriminant effect (constant: 0.526) followed by verbal learning and memory functions test (0.122).

Discussion

Statistical comparison of the two groups of subjects clearly reveal that the SD group has disadvantage in several cognitive areas compared to the teetotaller group. Memory is the function most commonly reported to be susceptible for impairment in alcohol dependence and abuse. The present study does partially support this in the case of social drinking. The first and the subsequent trial responses on the verbal and visual learning and memory functions tests show that the TT group has done significantly better in terms of immediate recall. But in terms of the learning effect both the groups show comparable increments from trial I to III. In verbal learning test, the TT and the SD groups showed mean increments of 14.6 and 12.7 respectively, and in the visual learning experiment, there was 7.8 and 7.1 respectively. Analysis has shown that the rate of learning is not affected in the SDs, though there is a significant disadvantage in the immediate recall. Repeated exposure to the same stimulus material and task demand did not help the SDs to improve their percentage of immediate recall. The performance lag noticed in the SDs persists over the trials. Similarly percentage of delayed recall as a ratio of III trial response in the two paradigms are also comparable in the two groups. The difference in the performance between the two groups thus appears to be that of initial acquisition. This is markedly different from the findings we have observed in alcohol dependent patients [13] and patients with other known lesions of the brain [10], [11]. In these studies, the alcohol dependent patients and the patients with closed injury have a significantly reduced rate of learning from Trial I to III, compared to the normal controls. In lesions other than in the axial structures the delayed recall reaches 75-90% of the third trial responses, whereas in lesions of the axial structures the delayed recall is significantly impaired compared to the third trial performance. Memory disturbance reported in alcoholic patients generally belong to the second category wherein there is significant loss of information over time. The performance profile of the SDs is in their capacity to enhance information intake from Trial I to III. The immediate recall does not improve by learning as in the TT group. A consideration of the task demand in these two tests show that the process of acquisition involves categorization based on sequential processing and logical relations. Hence recall is not dependent on an automatic processing

mechanism, but involves control processes [14]. Automatic processing facilitates rapid recall requiring little voluntary effort on the part of the subject. In control process the subject has to make voluntary effort to recall the information using logical and sequential associations embedded in it. Frequent recall of the same information or application of a skill facilitates automatic processing, and even those tasks which may initially require control processing involving selective attention and recruitment of responses may be later recalled by automatic processing. The recall of the passage in the verbal and visual learning and memory tests used in this study may be considered to require greater degree of control processing and hence could not become automatic over the three trials. The results suggest that control processing is affected in the SDs [9] group compared to the TTs.

Analysis of variance with repeat measures on the tests of verbal and visual learning and memory functions revealed a significant main effect for the groups. This supported that the third trial advantage seen in the TT group also affected the fourth trial response. Nevertheless there is no evidence to show that the group x repetition effect is significant in the two tests. There has been conflicting findings regarding verbal and visual memory deficits in SDs A few studies [15], [16], [17] have documented an impairment in verbal memory while others [18], [19] have failed to find evidence for this. The same has been found to be the case regarding visual memory deficits in SDs as there are conflicting reports [16], [20] of such deficits. On the RPM the mean number of correct responses of the SDs [1] group is significantly lower than that of the TTs, though this cannot be considered to indicate an impairment. The RPM is a test involving visuospatial analysis and synthesis and visuospatial abstract problem solving ability. A higher score of the TT group reflects a superiority in the total approach to abstract problem solutions, but it does not help us to identify the possible superiority of any subcomponent. Significantly lower abstract reasoning scores have been reported [21] in alcoholic subjects compared to nonalcoholics. In the Digit-Symbol Substitution Test the SDs' took significantly longer time than the TTs' to complete the task. This test has been considered to measure visual processing, immediate memory, ability to maintain complex and flexible response set, speed of psychomotor output and visuomotor coordination [22]. That the quality of performance of SDs group was as good as that of the TTs group except for the longer time taken by the former signifies that the slowness could be a function of slow shift of response set and/or psychomotor output in them.

The decrement of initial data acquisition and its persistent effect over trials and the disadvantages seen in the other tests in the SDs are modest. Nevertheless the question arises if this has any clinical relevance at all? For example, are these to be taken as subclinical features of alcohol induced brain dysfunction? Studies [23], [24] have suggested that such subclinical features may originate early in the drinking career, and that even if social drinking may not progress or culminate in subsequent alcohol abuse and alcohol dependence, risk for adverse consequences is suggested to be present. The time taken on the Digit-Symbol Substitution test is found to be present. The time taken on the Digit-Symbol Substitution test is found to have high correlations with three drinking variables, viz.,
(a) mean QPO in the week prior to the wash out (0.37),
(b) total consumption in the last 2 weeks prior to testing (0.37), and
(c) number of drinking occasions in the weeks prior to wash out (0.27).

The first variable (a) is found to have a correlation of 0.31 with visual learning third trial score, and a correlation of 0.23 with verbal learning third trial score. The correlation data suggest the possibility that the disadvantage seen in the SDs on various tests may be a function of the last drink they had rather than a permanent change caused by other drinking variables considered here.

The study has taken care to see that no subject with a family history of alcoholism or other psychiatric disorders are selected. Thus we are compelled to explain the disadvantage seen in the SDs purely on the basis of drinking habits of the individual. Variables related to patterns of drinking immediately prior to testing are the ones found to be significant of SDs. It is also not established if the inadequacies seen in the SDs are long lasting or merely a cumulative effect of frequent and prolonged alcohol consumption from which the subject can recover either by abstaining or reducing the quantity and frequency of alcohol consumption. The 'carry over' hypothesis [15] which suggests that alcohol exerts transient negative cognitive effects which persist well beyond the acute effects may also explain the information processing inadequacies seen in social drinkers. A long term follow-up study taking into account the complex methodological issues alone will provide satisfactorily answers in this area.

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