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Working Memory Among Tobacco Dependent Smokers and Non Smokers

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KEYWORDS:

Introduction:
One of the leading risk factor for global disease burden in 2010 was tobacco smoking including secondhand smoking. Globally 6.6 million lives were lost in 2010 due to smoking. Tobacco smoking accounted for 6.3% of global disability adjusted life year (DALY). The 2010 global burden of disease applies consistent method to the largest global data base ever assembled to estimate risk of premature mortality and contribution to health burden from a wide variety of risks; smoking, alcohol, HIV/AIDS, diet and outdoor air pollution which covered 187 countries globally.

Smoking and Executive Functions
The term executive function describes a set of cognitive abilities that control and regulate other abilities and behaviors. Executive functions are necessary for goal-directed behavior. They include the ability to initiate and stop actions, to monitor and change behavior as needed, and to plan future behavior when faced with novel tasks and situations. Executive functions allow us to anticipate outcomes and adapt to changing situations. The ability to form concepts and think abstractly is often considered as the components of executive functions. Executive functions are important for successful adaptation and performance in real-life situations.

Many reviews suggest that in spite of these physical complications the person who consumes cigarette on daily basis may also encounter certain cognitive deficits. A number of studies have shown poorer executive functions, general cognitive functioning, and/or problem-solving abilities in smokers when compared to nonsmokers (Durazzo et al 2007; Paul et al 2006; Razani et al 2004). Among recovering alcoholics who smoke, duration of smoking is inversely related to performance on measures of executive cognitive functions (Durazzoet al 2007). Working memory, which serves to maintain plans and intentions in short-term memory so the executive system can organize behaviour in a coherent, goal-directed manner (Fuster1997; Fuster 2000) also is negatively affected by smoking (Ernst et al 2001). Further, impulsivity, which may represent deficient behavioural self-regulation (Kaye et al 1990; Luria 1980), is associated with higher smoking rates and decreased time to relapse after smoking cessation (Doran et al 2004; Skinner et al 2004). The orbitofrontal/disinhibition model predicts that smokers will perform poorly on neurocognitive tasks which are controlled by orbitofrontal region of the brain leading the hypothesis of orbito frontal dysfunction and will obtain significantly higher scores on measures of behavioral disinhibition and antisocial personality in comparison to nonsmokers (Dinn et al 2004).

Need for the study:
A number of studies have shown poorer executive functions, general cognitive functioning, and/or problem-solving abilities in smokers when compared to nonsmokers (Durazzo et al 2006; Paul et al 2006; Razani et al 2004), but at the same time there are studies which show contradictory findings also (Reitz et al 2005). For instance, Buelow & Melissa (2009) conducted a study among smoker's and the result shows showed limited support for regular intake of nicotine and related executive function deficits. In India the scenario is something different as a large volume of studies have been done in other substances such as alcohol and opium but little is explored in connection with executive. The present study may yield valuable result in the light of contradicting western literature.

A**IM:** To find out the difference in working memory between tobacco dependent smokers and non smokers

METHODS AND MATERIALS: sample for the study comprised of 60 subjects. A sample of 30 tobacco dependent smokers and 30 non-smokers were recruited from the Sri Ramachandra Medical College Campus, Chennai and outside the campus. The age range of participants were 18 to 40 years. ICD-10 criteria for Mental and Behavioral disorder due to Tobacco dependence syndrome currently active dependence were used for selecting the smokers. sampling technique of purposive sampling was adopted to test the hypothesis of the study. Inclusion Criteria: Those who are willing to give informed consent, Subjects having more than 8 years of formal education. Exclusion Criteria: Presence of any primary neurological or psychiatric illness, Those who are having any other substance taking behavior, Subjects having serious neuro- sensory deficits. Hypothesis: There will be significant difference between tobacco dependent smokers and non smokers on executive functions

Tools used: Trial Making test (Reitan, 1958) was used to test the Working memory of the Smokers and non-smokers.The trial making test was developed by Reitan in 1958. The test was standardized by Partington and Leiter who found the test to be a good predictor of general mental ability. Trial making test consists of 25 circles distributed over a sheet of paper. In part A the circles are numbered 1-25, and the client should draw lines to connect the numbers in ascending order. In part B the subjects are instructed to join the alphabets and letters in an alternating fashion without lifting the pen or pencil from the paper. The time taken to complete the task and the number of errors committed will be calculated. Scoring is done by estimating the total time taken and number of errors committed. Statistical analysis: The data obtained was analyzed using student t test and ANOVA.

RESULTS:
TABLE 1: DEMOGRAPHIC DETAILS OF THE RESPONDENTS

DEMOGRAPHIC VARIABLES	SMOKERS (N=30) MEAN ± SD	NON-SMOKERS (N=30) MEAN ± SD	t	p
Age	25.70 ± 5.28	26.00 ± 4.59	.19	.849
Education	16.30 ± 2.32	17.10 ± 2.31	1.09	.282
Cigarettes per day	10.05 ± 4.63	.00 ± .000	9.71	.001

The mean age of smokers are 26 years ± 5.28 and the mean age of non smokers were 26.00 ± 4.58.student 't' test score reveals that there was no significant difference between these two groups with regard to age(t=0.19, p=.849). The mean of number of years of education of smokers are 16 ± 2.32 and the mean of number of years of non smokers are 17 ± 2.31. student 't' test score reveals that there was no significant difference between these two groups with regard years of education (t=1.09, p = .282). The mean of cigarettes used by the smokers are 10 ± 4.63 and mean cigarettes by non smokers was

found to be 0. The t score for cigarettes between two groups 9.71(p= .001) indicating there is a significant difference between two groups with regard to smoking status.

TABLE 2: WORKING MEMORY OF SMOKERS AND NON-SMOKERS

VARIABLES	SMOKERS (N=30) MEAN ± SD	NON SMOKERS (N=30) MEAN ± SD	t	p
TMT A	29.65 ± 3.88	24.10 ± 3.60	4.69	.001
TMT A Error	.60 ± .821	.15 ± .37	2.239	.031
TMT B	71.95 ± 11.23	68.50 ± 6.63	1.18	.244
TMT B Error	.85 ± 1.27	.70 ± .80	.447	.657

The mean scores on TMT A of smokers is 29.65 ± 3.88 and the mean scores on TMT A of non smokers are 24.10 ± 3.60.The t score between smokers and non smokers of TMT A was found to be 4.69 (p≤.000) indicating there is a significant difference between these two groups. The mean scores on TMT A Error among smokers is .60 ± .821 and the mean score on TMT A Error of non smokers is .15 ± .37. The t score for TMT A Error between smokers and non smokers was found to be 2.239 (p≤.031)indicating there is a significant difference between these two groups. The mean scores on TMT B of smokers was found to be 71.95 ± 11.23 and the mean of non smokers was 68.50 ± 6.63.The t score of TMT B is 1.18 (p≤.244) indicates that there is no significant difference between two groups. The mean score on TMT B Error among smokers is .85 ± 1.27 and the mean score of TMT B of non smokers is .70 ± .80 the t score for TMT B Error between two groups is .447(p≤.657) indicating there is no significant difference between these two groups.

Table 3: CORRELATION BETWEEN WORKING MEMORY, AGE AND EDUCATION IN SMOKERS

Trail Making Test	Age	Education	NO.OF CIGARETTES
TMT B	.303	-.511*	.459*
TMT B Error	.328	.199	.449*

There is a positive relationship between TMT B score and number of cigarettes smoked, TMT B Error score and number of cigarettes smoked. There exist negative correlation between TMT B Score and Education among smokers.

Table 4: CORRELATION BETWEEN WORKING MEMORY, AGE AND EDUCATION IN NON- SMOKERS

Variables	Age	Education
TMT A	-.475*	.605**
TMT A Error	.480*	-.223
TMT B	.002	-.603**

There is negative correlation between age and TMT A score and Age and TMT B Score and Education. TMT A Score is positively correlated with Education among non-smokers.

DISCUSSION:

TRAIL MAKING TEST: In the current study the scores in TMT A is significantly higher (p< 0.05) in smoking group than the non-smoking group. There is no statistically significant difference between the two groups in the scores of TMT A error (p 0.031), TMT B (p 0.244), TMT B error (p 0.657). The tests of trail making test have been hypothesized to reflect a wide variety of cognitive processes including attention, visual search and scanning, sequencing and shifting, psychomotor speed, abstraction, flexibility, ability to execute and modify a plan of action, and the ability to maintain two trains of thought simultaneously (Lezak, Howieson & Loring, 2004). In the present study smokers had taken more time for doing the Trail A part, showing minimal deficits in all the above said cognitive functions. However, the deficits can be reported to be in milder level as the smokers have no statistically significant difference in their scores in trial A error, Trail B and Trail B error. Further studies including more sample may give some light on the observed findings.

With respect to the neuropsychological assessments, the smokers have got significantly low T-scores on TMT – A of trail making test, total number of moves, total time of initiation, total time of execution.

SUGGESTIONS: Longitudinal research can be carried out to know the influence of nicotine dependence in executive functions. The study can be done in a large sample with newer advanced neuro-psychological testing such as CANTAB to yield more reliable research findings.

CONCLUSION: Overall the study indicates that there is significant difference between the smokers and non-smokers with respect to the executive functions of working memory including level of inhibition, attention, visual search and scanning, sequencing and shifting, psychomotor speed, abstraction, flexibility, ability to execute and modify a plan of action and planning when compared with the non-smokers.

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