A COMPARATIVE STUDY OF HAND DOMINANCE AND ASSESSMENT OF COGNITIVE FUNCTION BY REACTION TIME IN NON SMOKERS AND CHRONIC SMOKERS

Madiha Mehvish1, Anupriya Deshpande2

1Assistant Professor, Department of Physiology, IMSR, Mayani, Satura, Maharashtra, India.
2Assistant Professor, Department of Physiology, IMSR, Mayani, Satura, Maharashtra, India.

ABSTRACT

BACKGROUND
The smoking has been used by humans for its psychoactive properties for thousands of years. Reaction time (RT) is the elapsed time between the presentation of a sensory stimulus and the subsequent behavioural response. The aims and objectives of our study are to compare the hand dominance and cognitive function by reaction time in both smokers and non-smokers group.

MATERIALS AND METHODS
The study was conducted on 100 subjects [50 controls which are included in Group A and 50 smokers formed the Group B]. All the subjects of our study were recruited according to the inclusion criteria like apparently healthy male subjects in the age group of 40–60 years. Reaction time was recorded and analysed statistically by students paired "t" test.

RESULTS
We found that there is decrease in reaction time when recorded with left hand in both the groups compared to the right dominant hand and the simple reaction time for cognitive function also showed lesser reaction time in smokers in comparison to the non-smokers.

CONCLUSION
We conclude our study with the findings that non-dominant hand shows faster reaction time in comparison to non-smokers. The simple reaction time for both visual and auditory reaction time is decreased in smokers group compared to non-smokers.

KEYWORDS
Reaction Time, Smokers, Smoking Index.


INTRODUCTION
The smoking has been recorded in different cultures across the world. Nicotine, an alkaloid found in tobacco leaves, has been used by humans for its psychoactive properties for thousands of years. It is only in the last several decades that the cellular and physiological mechanisms underlying nicotine complex effects on brain function and behaviour, including nicotine abuse and dependence liability and its effects on cognitive function, have begun to be revealed.1 In addition to its well-documented addiction liability, nicotine is also known to enhance aspects of cognitive function, including attention and memory.2 chronic cigarette smoking has been associated with altered cognitive performance in middle age.3

The effect of smoking over all on health status is best described by using the smoking index. Smoking index is equal to multiplication of the average number of cigarettes smoked per day and duration (in years) of tobacco smoking.4
- Smoking index 1-100 —mild smoker
- Smoking index 101-200 —moderate smoker
- Smoking index >200 —heavy smoker

Pack years is number of packs of cigarettes per day multiplied by total duration of smoking in years (1 pack=20 cigarettes).

Reaction time (RT) is the elapsed time between the presentation of a sensory stimulus and the subsequent behavioural response.5 In psychometric psychology it is considered to be an index of speed of processing. Hide Wikipedia is getting a new look Help us find bugs and complete user interface translations That is, it indicates how fast the thinker can execute the mental operations needed by the task at hand. In turn, speed of processing is considered an index of processing efficiency. The behavioural response is typically a button press but can also be an eye movement, a vocal response, or some other observable behaviour.

Psychologists have named three basic kinds of reaction time experiments.5 In simple reaction time experiments, there is only one stimulus and one response. ‘X at a known location,’ ‘spot the dot,’ and ‘reaction to sound’ all measure simple reaction time.

The aims and objectives of our study are to compare the hand dominance and cognitive function by reaction time in both smokers and non-smokers group.

MATERIALS AND METHODS
The study was conducted on 100 subjects [50 controls which are included in Group A and 50 smokers formed the Group B]. This study was done for duration of one year after obtaining the permission of the Ethical committee of the institution.

The present study includes apparently healthy male subjects in the age group of 40–60 years. The inclusion criteria for Group A: Non Smokers [Control group]
Right handed 50 apparently healthy male subjects of age group 40-60 yrs. of same socioeconomic status non-alcoholic non-smokers. Group B: Smokers [Smokers group]

- 50 apparently healthy male subjects of age group 40-60 yrs. who smoke more than 10 cigarettes for more than 2 years and non-alcoholic.

Exclusion Criteria include subjects below 40 yrs. and above 60 yrs. of age, females, diabetics, alcoholic, colour-blind, blind, deaf and subjects suffering from ear diseases. Detailed history, name, age, sex, occupation, and personal history, personal habits of the subjects are taken. Smoking history was taken in detail. Family history of hypertension, diabetes, was enquired.

These were noted in a Personal Performa and following Parameters Concerned with the study were recorded.

1. Auditory Reaction Time [ART] of both hands of both groups.
2. Visual Reaction Time [VRT] of both hands of both groups.
3. Smoking Index [SI] was calculated for smokers group.

The Auditory and visual reaction time was measured by using reaction time apparatus. This apparatus is a portable research reaction timer with 2 response choices. It has an inbuilt chronoscope- 4-digit chronoscope with least count of 1/1000 seconds and works on 230 volts AC. All the study subjects were thoroughly acquainted with reaction time apparatus and 3 readings were taken after practice trials for visual reaction time namely green and red stimuli and the auditory reaction time was recorded thrice for tone and click stimuli. The mean of these three recordings were considered. Reaction time was recorded using the dominant hand first and then non-dominant hand.

**RESULTS**

**Graph-1: Age distribution of subjects studied**

Graph 1 depicts the age distribution of subjects in both smokers group and non-smokers group. This shows that maximum (56%) Non-smokers are aged between 40-50 yrs. and maximum (68%) smokers are aged between 51-60 yrs.

<table>
<thead>
<tr>
<th>Smoking Index</th>
<th>Number of Smokers</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;300</td>
<td>23</td>
<td>46.0</td>
</tr>
<tr>
<td>301-500</td>
<td>22</td>
<td>44.0</td>
</tr>
<tr>
<td>&gt;500</td>
<td>5</td>
<td>10.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>50</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

**Table 1: Smoking Index of study subjects**

Table 1 depicts the percentage distribution of smoking index. This table shows that the maximum percentage (46%) of smokers have smoking index <300.

**DISCUSSION**

Smoking has a negative impact on overall health. It may also accelerate cerebral atrophy, perfusion decline and white matter lesions. In contrast, nicotine has plausible mechanisms for aiding cognitive function. Throughout the cholinergic system there are nicotinic acetylcholine receptors which can bind to nicotine. Use of nicotine as an agonist is said to up regulate these receptors in a dose dependent fashion, possibly by several hundred percent, depending on brain region. The use of nicotine has also been found to aid attention, reaction time and some learning and memory.

We found in our study that the reaction time for right hand in smokers group is less than the non-smokers group which is highly significant [p<0.001]. The reaction time for left hand in non-smokers group is more than the smokers group but it is highly significant [p<0.001] only for Green colour.

Table 2 and its graphical presentation depicts the comparison of reaction time in two groups of subjects studied by hand dominance.

Results are presented in Mean±SD, P value **indicates p<0.001

<table>
<thead>
<tr>
<th>Reaction Time</th>
<th>Non-Smoking Group</th>
<th>Smoking Group</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right hand</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green</td>
<td>0.290±0.027</td>
<td>0.244±0.03</td>
<td>0.001**</td>
</tr>
<tr>
<td>Red</td>
<td>0.223±0.03</td>
<td>0.196±0.029</td>
<td>0.001**</td>
</tr>
<tr>
<td>Tone</td>
<td>0.173±0.024</td>
<td>0.159±0.016</td>
<td>0.001**</td>
</tr>
<tr>
<td>Click</td>
<td>0.170±0.023</td>
<td>0.154±0.024</td>
<td>0.002**</td>
</tr>
<tr>
<td>Left hand</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green</td>
<td>0.219±0.033</td>
<td>0.201±0.029</td>
<td>0.003**</td>
</tr>
<tr>
<td>Red</td>
<td>0.210±0.037</td>
<td>0.202±0.026</td>
<td>0.236</td>
</tr>
<tr>
<td>Tone</td>
<td>0.170±0.026</td>
<td>0.166±0.016</td>
<td>0.289</td>
</tr>
<tr>
<td>Click</td>
<td>0.165±0.025</td>
<td>0.161±0.025</td>
<td>0.395</td>
</tr>
</tbody>
</table>

Table 2: Comparison of reaction time in two groups of subjects studied by hand dominance
also noted that the auditory reaction time to high pitch and low pitch sound is actually raised in non-smokers group compared to smokers group. So tobacco smoking results in reduced auditory reaction time. 

The findings of our studies are similar with findings of studies done by Mac Donald and others. MacDonald,7 found that reaction time variability in older adults was usually associated with slower reaction times. In a study conducted by Ichaporia R,8 there was a significant decrease in the visual and auditory reaction times in smokers as compared to healthy controls of the same age. The acute effect of smoking one cigarette was also studied in the same group of smokers and a statistically significant reduction was found, as compared to their basal VRT and ART. In other study also researchers have reported that smoking a cigarette may lead to the maintenance of a higher level of efficiency in the simple reaction time. Pj. Fay,9 studied the effect of cigarette smoking on simple and choice reaction time to coloured lights. Regular smokers tend to react more rapidly to reaction time and non-smokers are little affected.

In our study, Reaction Time was found to be significantly decreased (p<0.001) compared with controls. The reaction time for right hand in non-smokers group is more than the smokers group which is highly significant (p<0.001). The reaction time for left hand in non-smokers group is more than the smokers group but it is highly significant (p<0.001) only for Green colour.

Our study showed that the reaction time is slow in dominant hand. The right hemisphere controls the left hand, and the left hemisphere controls the right hand. Thus the non-dominant hand is faster at reaction times involving spatial relationships.10-12

CONCLUSION

We conclude our study with the findings that non-dominant hand shows faster reaction time in comparison to non-smokers. The simple reaction time for both visual and auditory reaction time is decreased in smokers group compared to non-smokers.

REFERENCES


