

Original Research Article

Smoking Index and Auditory Reaction Time- A Comparative Study

Dr. Madiha Mehvish¹, Dr. Veeresh B Salgar²

¹Assistant professor, Department of Physiology, USM-KLE, Belagavi, India

²Associate professor, Department of Medicine, GIMS, Kalaburgi, India

***Corresponding author**

Dr. Madiha Mehvish

Email: drmadihamehvish@gmail.com

Abstract: Tobacco smoking is known as one of the most abused drugs for all ages. Cigarette is a factor affecting reaction time due to stimulant property of its active ingredient nicotine. Smoking can be assessed by smoking index. Smoking index [SI] is equal to multiplication of the average number of cigarettes/bidis smoked per day and duration (in years) of tobacco smoking. The objective is to measure and compare auditory reaction time in smokers with different smoking index. To evaluate smoking index as a factor associated with auditory reaction time changes. 50 apparently healthy male smokers aged 40-60yrs were considered for the study. The detail smoking history was taken and the auditory reaction time was recorded by Reaction Timer, 3 readings were considered and finally average of 3 readings was taken and student's t test was used for analysis. p value <0.05 was considered as statistically significant. In our study we found that the reaction time to high pitch and low pitch sound is increased in smokers with higher smoking index compared to smokers with lower smoking index which is in contrast to many other studies done in past that showed smoking causes decrease in reaction time. We conclude our study with the observation that smoking index has an influence on central nervous system but as majority of our study subjects are elderly in age group of 51-60 years which might have produced an increase in auditory reaction time.

Keywords: Smoking index, tobacco, auditory reaction Time

INTRODUCTION

Tobacco has been used in different forms since ancient times. The poor are more likely to smoke than the wealthy, and people of developing countries than those of developed countries [1]. Tobacco use including both smoking and nonsmoking forms of tobacco is common in India. Global Youth Tobacco Survey Study reported that in our country 1/3rd of all the men are addicted to tobacco smoking before reaching the age of 20 years [2]. According to world health organization, the prevalence of smoking globally is estimated to be about 22.7% by 2020 as one third of the male population are active smokers [3].

Tobacco smoking is known as one of the most abused drugs for all ages. There are universal problems concerns over drug use by teenagers. cigarette smoking has been identified as the single most significant cause of preventable morbidity and premature deaths and it has been estimated that an average of 7 minutes of life is lost for each cigarette smoked, roughly the time taken

to smoke it. A person who begins smoking at the age of 15 years has an average of 8 years of reduced longevity and starting after 25 years of age faces an average 4 years reduction [4].

The reaction time is assessed by processing speed of central nervous system [5]. It is an index of cortical arousal and has been recognized as a potentially powerful means to assess the integration of sensory, motor and coordination system of the body in response to an external stimulus. Cigarette smoking has a stimulant effect on nervous system due to its active component nicotine which is supposed to alter reaction time.

Nicotine has a property that is known to cause addiction. In beginning phase of nicotine intake the activity of the dopamine neurons is more which influences the rewarding centre [6]. Chronic exposure to small amount of nicotine can result in desensitization

of the nicotinic receptors leading to acute tolerance to nicotine's effects.

There is an interplay between activation and desensitization of multiple nicotinic receptors. These receptors are involved in more in modulation in comparison to the processing of fast synaptic transmission. These cellular events contribute to the nicotine addiction. Some studies done in past suggests that more pleasure is derived from first cigarette [7].

The nicotine has potential for abuse and dependence and this effects are centrally mediated by neuroregulatory mechanism. This affects biochemical and physiological functions in such a way that results in addiction and drug abuse.

With each cigarette smoked, there is a dose-dependent increase in neurotransmitter and neuroendocrine effects due to increase plasma nicotine levels. The plasma levels of neurotransmitters like norepinephrine and epinephrine increase, and there is alteration in the bioavailability of the dopamine.

The neuroendocrine effects are due to release of arginine vasopressin, beta-endorphin, adrenocorticotrophic hormone and cortisol. These neurochemicals are known to modulate the human behavior. The affective states and cognitive demands are changed by nicotine intake. The neuroregulatory effects of inhaled nicotine are immediately available and the reinforcing effects of the drug are maximum [8].

To know the quantity of cigarette smoked we use the term smoking index. This Smoking index is a parameter to express cumulative smoking exposure quantitatively. It is equal to multiplication of the average number of cigarettes/bidis smoked per day and duration (in years) of tobacco smoking [9].

Smoking index 1-100 —mild smoker.
Smoking index 101-200 —moderate smoker.
Smoking index >200 —heavy smoker.

Reaction time (RT) is the duration of time between the application of a sensory stimulus and its subsequent behavioral response which is usually manifested as an ocular movement, release of a pressed button or pressing a button, a verbal response or other recognized behaviors. RT includes auditory reaction time or visual reaction time. RT is usually used in research area namely mental chronometry involved in

the experimental psychology operations. It is considered as an index of speed of processing¹⁰ in psychometric psychology. Reaction time indicates how fast a thinker can actually execute the mental operations required by the task at hand. Thus the speed of processing is considered as an index of processing efficiency.

AIM

The aim of our study is to measure and compare the auditory reaction time in smokers with different smoking index.

MATERIALS AND METHODS

The study was conducted in M.R.M.C. Kalaburgi, after obtaining the permission of the Ethical committee of our institution. This study includes healthy male subjects in the age group of 40– 60 years of Kalaburgi city who smoke more than 10 cigarettes for more than 2 years. Diabetics, alcoholics, deaf subjects and people suffering from ear diseases were excluded from the study. A detailed history, name, age, sex, occupation, and personal history, personal habits of the subjects are taken. Smoking history was taken in detail after informed consent was sought and obtained from each of them.

The Auditory reaction time was measured in a quiet room with good illumination after the light breakfast by using portable reaction timer with 2 response choices Anand agencies, Pune-2. Auditory signals were given from the other side of the subject with instruction to use index finger of the dominant right hand to release the response key. All the subjects were thoroughly acquainted with apparatus and 3 readings were taken after practice trials for two stimuli namely tone and click for Auditory reaction time

RESULTS

The results obtained in this present study from total number of 50 subjects are depicted in the tabular form and Figures.

Table 1: Age distribution of study subjects

Age in years	Smokers	
	N[50]	%
40-50	16	32.0
51-60	34	68.0
Total	50	100.0

Table 1 depicts the age distribution of smokers. This table shows that maximum (68%) smokers are aged between 51-60yrs.

Table 2: Smoking Index

Smoking Index	Number of smokers	Percentage (%)
<300	23	46
301-500	22	44
>500	5	10
Total	50	100

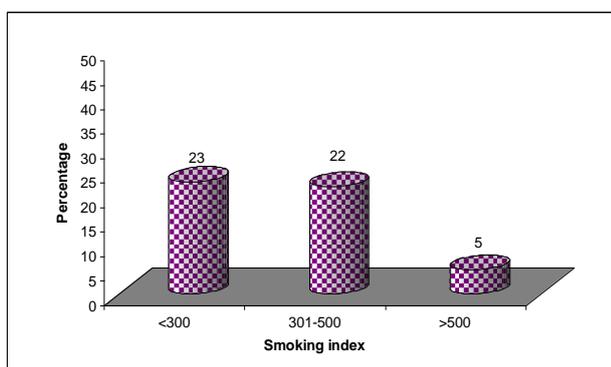


Fig-1: Smoking Index

Table 2 and Figure 1 depict the percentage distribution of smoking index. This table shows that the maximum percentage (46%) of smokers have smoking index < 300.

Table 3: Comparison of auditory reaction time: Tone and click according to Smoking Index

Smoking Index	Number of smokers	Tone	Click
<300	23	0.156±0.016	0.156±0.024
301-500	22	0.161±0.016	0.152±0.026
>500	5	0.164±0.011	0.157±0.021
Significance		P=0.541	P=0.798

Table 3 depicts the comparison of reaction time for Tone and click according to smoking Index. As the smoking Index is increasing, the reaction time is also increasing for tone and click, which is statistically not significant. It is also observed that the reaction time for tone was more than click for subjects with smoking index ranging between 301-500 and more than 500.

DISCUSSION

Many studies were conducted in the past on reaction time and cigarette smoking. Most of the studies

have shown the results that nicotine being an active ingredient in cigarette or beedi produces a significant stimulant effect on central nervous system and by virtue of this stimulant property the reaction time tends to be faster. The literature on reaction time shows that age and tremors are among the factors altering reaction time [10].

This study was done on 50 smokers to assess the effect of smoking index on auditory reaction time. We found that all the study subjects were heavy smokers with smoking index more than 200. In our study we found that the auditory reaction time to high pitch [tone] and low pitch [click] sound is decreased in smokers with smoking index <300 and with increasing smoking index the reaction time increased. This is possibly because of age factor as majority of our study subjects are aged between 51 to 60 years. With increase in age beyond 50 years many degenerative changes occur in the body especially in the nerves leading to disease conditions like slowing of conduction velocity in motor nerves, segmental demyelination, increased fibrosis and age related decline in psychomotor speed leading to delayed response in elderly individuals [11].

Studies done in the past indicated that the processing capability of central nervous system altered is reflected by the changes in auditory and visual reaction times can be due to impaired perceptual-motor coordination in chronic smokers. The another reason for increased reaction time with increasing smoking index may be due to desensitization or down-regulation of nicotinic receptors of acetylcholine, or chronic stimulation of the nicotinic receptors of acetylcholine leading to tachyphylaxis [12].

Few researchers speculates on the reason for slowing or increasing reaction time with age [13]. It is not just simple mechanical factors like the speed of nervous conduction. It may be the tendency of older people to be more careful and monitor their responses more thoroughly [14]. Brebner [15] reported in a study that fingers tremble up and down at the rate of 8-10 cycles/sec, and reaction times are slower if the reaction occurs when the finger is already on the 'upswing' part of the tremor.

In a study conducted by Ichaporia R [16], there was a significant decrease in auditory reaction times in smokers as compared to healthy controls of the same age.

CONCLUSIONS

In our study we found that all the study subjects had smoking index more than 200 which indicates that all of them were heavy smokers. The auditory reaction time to the high pitch sound [tone] and low pitch sound [click] is decreased in smokers with smoking index <300 and with increasing smoking index the reaction time increased. This is possibly because of age factor as majority of our study subjects are aged between 51 to 60 years.

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