

Effect of Smoking and Dipping Tobacco on Auditory and Visual Reaction Time in Males: A Comparative Study of Different Age Groups

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Abstract

Background: Auditory reaction time (ART) and visual reaction time (VRT) are non-invasive techniques used to assess the capability of the CNS to integrate sensory and motor activities based on the level of CNS arousal and alertness. There is a lacuna for studying the impact of nicotine in smokeless tobacco users, therefore this study aimed to estimate and compare ART and VRT of smokers and dipping tobacco users with non-tobacco users in different age groups. **Methods:** Total 612 apparently healthy male subjects were divided equally on the basis of habit into three groups namely smokers, dipping tobacco users and control (non-tobacco user) with 204 subjects in each group. They were divided further on the basis of age into 4 sub groups like 11-20 years, 21-30 years, 31-40 years and 41-50 years with having 51 subjects in each group. RTM-608 (Medicaid system) apparatus was used to measure audio-visual reaction time under strict precautions and standard protocols to minimize the effect of other variables on reaction times. Data was analyzed using one way analysis of variance in each group. **Results:** All age groups differ significantly from each other for ART and VRT (ANOVA; $p < 0.05$). Significant reduction was found for ART & VRT for dipping tobacco users as compared to control and smokers ($p < 0.05$). ART and VRT increases with age in each group of control, smokers and dipping tobacco users. **Conclusion:** The audio and visual reaction time was significantly higher in older individuals. Reduction in ART and VRT were observed in the dipping tobacco users and smoker which shows acceleration of the response to stimulus. **Keywords:** Auditory reaction time (ART), visual reaction time (VRT), Smokers, dipping tobacco.

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INTRODUCTION

In India smoking and tobacco dipping are major health problems and one of the largest preventable causes of disease and premature death. According to WHO estimates, about 194 million men use tobacco in smoke or smokeless form in India. Out of this, 65% of all men use some form of tobacco (about 35% smoking, 22% smokeless tobacco, 8% both) in different age groups [1].

One of the most prominent pathophysiological changes is probably atherosclerosis of arteries and arterioles supplying blood to the cerebral hemispheres which may be due to long term tobacco usage.

In research studies, reaction time measures have been commonly used to assess the alertness of an individual. Reaction time, an index of processing capability of the central nervous system, depends on several factors. The delayed or fast reaction time indicates deteriorated or improved processing of central nervous system and or sensory motor performance [2].

Smoking in public places is prohibited nationwide by Indian government. Banning smoking at public places has actually led to an increase in another form of tobacco consumption: Dipping tobacco. Since introduction of nicotine is directly in blood, amount of nicotine absorbed is much higher in dipping as compared. Therefore in the present study, it was planned to estimate auditory reaction time (ART) and

visual reaction time (VRT) in smokers, dipping tobacco users and non-tobacco users in different age groups

MATERIAL & METHOD

The study of ART and VRT in healthy male subjects of different age groups has been planned with careful protocol prepared with precision. The experiments were carried out in the department of physiology Gujarat Homeopathic Medical College, Savli, located on the western coast of India after obtaining ethical approval.

Total 612 subjects were studied randomly for this research work in three groups.

- First group included 204 smokers who normally smoke not more than 10 year and not less than 5 year and smoke minimum 5 cigarettes a day not more than 10 cigarettes a day.
- Second group in the study included 204 dipping tobacco users who consumed tobacco orally for not more than 10 years and not less than 5 years and consume at least 5 times a day but not more than 10 times a day.
- Third group Controls were served by another 204 non tobacco users.

All the 612 subjects used in the research were all physically fit and non-alcoholics. Subject personal data, Physical bio data, clinical history was recorded in proforma. Some of the questions related to vision and hearing were also asked to the subjects. Participants in all the groups were recruited into 4 different age groups as 11-20 years, 21-30 years, 31-40 years and 41-50 years where each group had 51 subjects.

Experimental information such as ART and VRT were recorded in all the subjects by RTM-608 apparatus (Medicaid system, Chandigarh, India). Before interventions subjects were explained the nature of the experiment and the working of the instrument in different mother languages. The stress of the subjects was relieved by pre-informing them about the stimulus they are going to get during the study. They were

requested to remain ready by keeping their respective operative hand on seeing the bulb to glow and on hearing sounds of different intensities after fifteen minutes. Finally parameters for the ART and VRT were recorded in multiple repetition that in auditory stimuli for three sounds were selected and they were repeated in similar fashion, giving nine stimuli. Similarly nine parameter for visual stimuli of each color appearing for three times in succession of green, red and yellow in total and there was no change in the experimenter in any condition.

Data was analyzed using one way analysis of variance for within group analysis. Different parameters in each study group were also compared by using Turkey-Honestly test. The statistical significance were considered when $p < 0.05$. Data was analyzed by SPSS version 17.

RESULTS AND OBSERVATION

In the present study, in age groups ART and VRT values were significantly different (Table-1; ANOVA, $p < 0.05$) in all three groups, However a decreasing trend was there in ART & VRT values from control to smokers and dipping. Control group is having the highest mean value while dipping has lowest mean value. Post-hoc analysis found that in age groups 31-40 yrs and 41-50 yrs ART and VRT values are significantly different in dippers as compared to control but do not differ significantly from smokers group. Over the age groups, smokers and dipping tobacco users differ significantly from control.

ART and VRT values increase in control, smokers and dipping tobacco users as age advances. As regards ART values, age group 31-40 yrs differs significantly from age group 11-20 yrs and 21-30 yrs ($p < 0.05$), similarly age group 41-50 yrs differs significantly from age groups 11-20 yrs, 21-30 yrs and 31-40 yrs.

As regards, VRT values age groups differ from each other but age group 41-50 yrs differ significantly from age group 11-20 yrs and age group 21-30 yrs.

Table-1 Statistical analysis (ANOVA) for ART and VRT in different age groups

Age group (Yrs)	ART			P value	VRT			P value
	Control	Smokers	Dipping tobacco users		Control	Smokers	Dipping tobacco users	
11-20 (n=153)	.197±.009	0.185±.008	.157±.006	<0.05, S	.267±.011	.253±.010	.228±.010	<0.05, S
21-30 (n=153)	.207±.009	.183±.007	.157±.007	<0.05, S	.281±.008	.258±.006	.229±.008	<0.05, S
31-40 (n=153)	.235±.007	.215±.008	.175±.007	<0.05, S	.296±.007	.264±.007	.237±.007	<0.05, S
41-50 (n=153)	.257±.005	.229±.005	.199±.006	<0.05, S	.309±.009	.274±.009	.241±.009	<0.05, S

DISCUSSION

Present study found that all age groups differ significantly from each other for ART and VRT (ANOVA; $p < 0.05$). Significant reduction was found for ART & VRT for dipping tobacco users as compared to control and smokers ($p < 0.05$). ART and VRT increases with age in each group of control, smokers and dipping tobacco users.

This fast reaction time indicates improved processing capability of central nervous system and or sensory-motor performance which may be due to greater improved concentration power and ability to ignore and/or inhibit external stimuli [3]. The stimulating action of nicotine on human nervous system and shortening of reaction time has been reported in literatures which suggest that nicotine in the quantities taken by a human smoker can be a central nervous stimulating drug [4-6].

Study by Glad and Sundaramarthy reported decrease in ART and VRT values in dipping tobacco users which shows acceleration of the response to stimulus. The raise in the system's response is due to excessive adrenaline/ noradrenaline release and decrease in dopamine favorably modifies cognitive demands which in turn elicit or enhance "pleasure" [5, 7]. Myrsten *et al.*, study also believe that this temporary surge in these neurotransmitters may cause dipping tobacco users to have delay in the responses when they become chronic users. Also it could happen early if the addiction level increases greatly [8].

In the present study there is an acute speed up in the response to ART and VRT in dipping tobacco users and smokers. In dipping tobacco, introduction of nicotine is directly in to the blood, the effect could be so high if the quantity and frequency of dipping habit increases. Jadhao *et al.*, reported that both auditory and visual reaction time were delayed in chronic smokers as compared to that in controls [9].

Nikam and Gadkari [2] reported that ART & VRT were significant higher in older individuals 65-75 years as compared to younger 18-20 years. Though the review of literature shows a common observation but nature of slow down is not very clear. All the component of reaction time, movement time and device response time are likely to get delayed in elderly. Senile changes in peripheral process, like decelerated muscular response and impulse transduction through sensory nerves can account for 20% of reaction time lengthening [10]. But Since sensory receipt and motor outflow times are believed to remain similar across lifespan, the cause could be the slowed processing rate of central nervous system in old individuals [11, 12].

It was found in the study as age advances smoking related changes in the ART and VRT also go on increasing due to various changes occur in nerves as increased fibrosis, segmental demyelization and degeneration but more prominent beyond 50 years of age [9]. Chandak and Makwana evaluated the ART and VRT in two age groups viz 21-45 years and 46-60 years and found significant increase with advanced age [13].

Bates *et al.*, reported that nicotine acts as psycho active drug able to act at many sites in both central and the peripheral nervous system. They also reported that nicotine reduced decision time a component of reaction time and the enhancing effect of nicotine are on either information processing or more particularly, on focused attention and vigilance [4].

CONCLUSION

Tobacco Smoking is associated with negative effect on several types of cognitive functions which can be assessed by reaction time. The delayed or fast reaction indicates deteriorated or improved processing capacity of central nervous system and sensory motor performance. The audio and visual reaction time was significantly higher in older individuals as compared to younger individuals. Similarly in each age group dipping tobacco users and smokers differed significantly from control as for audio and visual reaction time and in dipping tobacco users and smokers, reduction in ART and VRT were observed which shows acceleration of the response to stimulus.

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