MATERIALS AND METHODS

The mode of functioning of sensory processes has fascinated man for hundreds of years and he has devised an ingenious variety of methods for their study. For any situation, where a human subject can detect stimulation of a given sense receptor may be studied in human beings as an indicator of the effect of stimulation.

The study of auditory reaction time (ART), visual reaction time (VRT), blood pressure and pulse rate in healthy male subjects of different age groups and profession has been planned with careful protocol prepared with precision.

The concept of the study has been kept in front of eyes so that experiments could be carried out in existing available conditions. The present research project has been undertaken to find out and compare the audio reaction time, visual reaction time, blood pressure and pulse rate of tobacco users and non-users.

The experiments were carried out at Gujarat Homeopathic Medical College, Savli. Savli is located in the central part of Gujarat state which is located on the western coast of India. The city of Savli is situated between 22°34 North and 73°13 East, at a height of 35.5 meters from the sea level. The experiments were carried in the department of physiology.
It has been widely accepted that the method of basic research in which large number of human subjects having different lifestyles are involved, must be very simple and easy to understand. Care was taken to see that the subject felt free to adapt to the setting of the experiment. A constant and comfortable temperature was maintained at the experimental place throughout the duration of the experiment. Care was taken during the experiment to minimize the error so as to get accurate results.

In this experiment, it was not possible for us to collect a huge data for the parameters; however we have tried to collect a reasonably adequate data from a sample representing a large population.
**About the protocol**

Protocol: _________
Group: _________
Date: _________
Time: _________
Room temperature: _________

**A. Subjects personal data**

Name: ____________________________

Age _________  Sex___________

Religion _________
Education _________

Income___________ Rs./per month

Socio-economic class: - Poor class/middle class/ rich class
Address
____________________
____________________
____________________

Phone number
________

Mobile number
________

B. Subjects physical bio data

Smoking habit:
________

Smoking/Dipping since
________

Smoking/Dipping tobacco per day
________

Blood pressure________mm of mercury in right arm (supine position)

Resting pulse rate_____/minute beats

Respiratory rate_____per minute

Height_____cm

Weight______kg
C. Personal clinical history

Any major surgery: __________

Any visual or auditory illness: __________

Any other major illness: __________

Any chronic illness like TB/DM/HTN/Asthma: __________

Nature of work: __________

Specific remark: __________

Experimental Parameter

1. Auditory reaction time (ART) sec:

High pitch sound : _______ _______ _______

Medium pitch sound : _______ _______ _______
1. Low pitch sound: _______ _______ _______

Average: _______

2. Visual reaction time (VRT) sec:

Red light: _______ _______ _______

Green light: _______ _______ _______

Yellow light: _______ _______ _______

Average: _______

3. Blood pressure (mm of Hg).

Systolic: _______ _______ _______

Average: _______

Diastolic: _______ _______ _______

Average: _______

4. Pulse rate: _______/minute
Questionnaire

1. Can you identify and differentiate basic colour red, green and yellow?

2. Do you have any problem of vision during night?

3. Are you in position to identify the various intensity of sound by both ears?

4. Do your relatives and friends complain about your sense of vision and hearing?

5. Do you have any past history or recent head injury?

6. Have you come across any type of stress in recent past?
APPARATUS

The name of the apparatus used this project is audio-visual reaction time apparatus, RTM-608, designed and developed by group of technocrats of Medicaid system, Chandīgarh, India. It has the flowing specifications:

1. The display is clear readable panel fitted on the top of the apparatus with 8 digits.
2. It has resolution of 0.001 second and accuracy of +1 digit.
3. Chronographic display on screen is 9999.9999 sec.
4. The apparatus has three inbuilt bulbs of colours green, red and yellow.
5. The apparatus consists of three sets of continuous sounds of different pitch on the speaker. It can produce high pitch, medium pitch and low pitch sounds.

Apart from this unique facility the apparatus is of choice for the following special characteristics.

1. The apparatus selected for the study has easy portability, due to its light weight and dimensions of 390*295*90 mm dimensions.
2. This apparatus is exclusively designed for the study of the auditory reaction time (ART) and visual reaction time (VRT) by standard scientific laboratory, The Medicaid system, India.

3. The apparatus processes unique facility for the operating device in building up confidence among subjects within the subjects free from any mental stress while recording.

4. As demanded in scientific research work the apparatus has an electronic device for output of result with extreme sensitivity and accuracy.

Apart from these unique characteristics, the power is electrically supplied that leads to one and only drawback that it fails to be operated in absence of electric current, this dependency restricts in recording observations in very remote rural areas depraved of electricity.
Regarding Apparatus for Audio and Visual Reaction Time (RTM 608) in two different positions
PROCEDURE AND PRECAUTIONS

The standard protocol was followed for the experiment conducted. Before measuring the auditory reaction time (ART) and visual reaction time (VRT), the subjects were explained the nature of the experiment and the working of the instrument were explained to them and how to operate the instrument in the mother language of the subject Gujarati, Hindi, English or the language the subject was comfortable conversing in. Subjects were made comfortable and mentally free from any stress and anxiety before undergoing the experiment. They were asked to fill the questioner and their vitals were recorded. Setting arrangements was made comfortable before recording. Changes were made in the room as per requirement of the subject to make the feel more comfortable. The fan was turned on if the subject felt hot and the windows were closed if it was too cold. To allay the fears of the subject was given an option weather he wanted to be alone during the duration of the experiment.

This resulted in false hasty and correct responses due to confusion. Every subject was given sufficient time to understand the protocol and was given trial till the patent was comfortable performing the experiment. To avoid the subject’s curiosity of the future step, he was explained the chronological order of auditory and visual stimuli. Though attentiveness of the subject could have been tested by keeping him unaware of the order of stimuli, but it
was found after initial trials and experiments that merged into a small degree of mental stress and over consciousness.

In our experiments the following pattern was adopted for the experiment. The colours used to stimulate the subject for pressing the corresponding switch were GGRYY and GRY. Similarly the sound also explained.

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 auditory reaction time (ART) and visual reaction time (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 parameters for visual stimuli each colour appearing for three times in succession of green, red and yellow in total and there was no change in the experimenter in any condition. Blood pressure was measure in supine position. Pulse rate also taking in resting position. Controls were set as non-consumers of tobacco. The subjects who consumed tobacco, their auditory reaction time (ART), visual reaction time (VRT), blood pressure and pulse rate were recorded. They were given a cigarette each and after
consumption the auditory reaction time (ART), visual reaction time (VRT), blood pressure and pulse rate were recorded.

**Place of recording**

The experiments were carried out at Gujarat Homeopathic Medical College, Savli. Savli is located in the central part of Gujarat state which is located on the western coast of India. The city of Savli is situated between 22°34 North and 73°13 East, at a height of 35.5 meters from the sea level. The experiments were carried in the department of physiology.

**Time of recording**

Bio-rhythm is known to have an important role in a living beings life. Similarly in this experiment it was important to consider timing of the experiment as the same individual may have different reaction times at different time.

To avoid any extra influence of daily variation, the measurement of their auditory reaction time (ART), visual reaction time (VRT), blood pressure and pulse rate were recorded preferably during early morning hours. All parameters were recorded in morning between 8 to 10 hrs in all seasons.
No of Subjects:

The total number of subjects studied randomly for this research work are 612 including 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. Another 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. Controls were served by another 204 non tobacco users. All the 612 subjects used in the research were all physically fit and non-alcoholics.

All the groups were divided on the basis of age. The 204 smokers were distributed equally among 4 different age groups from 11-20 years 21-30 years 31-40 years and 41-50 years with each group having 51 subjects each. Similar distribution was done for the dipping tobacco users and the (non-tobacco user) controls.

<table>
<thead>
<tr>
<th>Inclusion Criteria</th>
<th>Exclusion criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male Subject</td>
<td>Female Subject</td>
</tr>
<tr>
<td>Exclusive Smoker or Dipping tobacco user</td>
<td>Tobacco in any other form</td>
</tr>
<tr>
<td>Non alcoholic</td>
<td>Suffered any eye or ear disease</td>
</tr>
<tr>
<td>No history of any eye or major illness</td>
<td></td>
</tr>
</tbody>
</table>
**Group specification**

1. **11 to 20 years:**

   This group mainly comprises of young children from the periphery areas where smoking and dipping tobacco use is a very prevalent practice. This age group mainly comprises of subjects who have been smoking five to ten cigarettes per day more than five years. Using tobacco in these subjects is considered as a status symbol and they aren’t usually addicts. The population for the study was taken mostly from first and second year BHMS students. Along with the students of BHMS, subjects were also obtained from the local population. The local population mainly comprised of children who used to work at tea stalls and labourers in farms. The usage of dipping tobacco is much more prevalent in this age population since dipping tobacco is very cheaply available.

2. **21 to 30 years:**

   This group mainly comprises of students. This is due to the peer pressure. These smokers aren’t usually addicted to nicotine. They smoke either due to the peer pressure or a belief that tobacco consumption increases their efficiency. These are usually the smokers of less than 10 years of tobacco usage. For this group subjects were mainly obtained from the final year and interns from GHMC, Savli.
3. 31 to 40 years:

This group mainly comprises of the middle aged tobacco users. These mainly usually include chronic tobacco users who have been smoking for more than 10 years. But for the purpose of the study, subjects were filtered and chosen only they smokes five to ten cigarettes per day and dipping tobacco five to ten times per day and the consumption of tobacco was less than 10 years.

4. 41 to 50 years:

This group mainly comprises of chronic smokers. These are usually dependents on nicotine and if they don’t get nicotine they usually develop withdrawal symptoms, but for the purpose of the study and to maintain uniformity in the study and to see whether age plays a factor in the effect of tobacco, the subjects were selectively filtered out and only tobacco users who have been consuming tobacco for less than 10 years were considered.

STATISTICAL ANALYSIS OF DATA

In the present study all data collected were analysed using SPSS version 17. The data were considered as mean ± standard error of mean (±S.E). Statistical analysis of the data was done using one way analysis of variance. Different parameters in each study group were also compared by using Turkey-Honesty test. The statistical significance were considered when p<0.05.
RESULT AND STATISTICS

Table no. 1

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Control ART (sec)</th>
<th>Smokers ART (sec)</th>
<th>Dipping tobacco users ART (sec)</th>
<th>Control VRT (sec)</th>
<th>Smokers VRT (sec)</th>
<th>Dipping tobacco users VRT (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-20 Years</td>
<td>0.197 ± 0.009</td>
<td>0.185 ± 0.008</td>
<td>0.157 ± 0.006</td>
<td>0.267 ± 0.011</td>
<td>0.253 ± 0.010</td>
<td>0.228 ± 0.010</td>
</tr>
<tr>
<td>21-30 Years</td>
<td>0.207 ± 0.009</td>
<td>0.183 ± 0.007</td>
<td>0.157 ± 0.007</td>
<td>0.281 ± 0.008</td>
<td>0.258 ± 0.006</td>
<td>0.229 ± 0.008</td>
</tr>
<tr>
<td>31-40 Years</td>
<td>0.235 ± 0.007</td>
<td>0.215 ± 0.008</td>
<td>0.175 ± 0.007</td>
<td>0.296 ± 0.007</td>
<td>0.264 ± 0.007</td>
<td>0.237 ± 0.007</td>
</tr>
<tr>
<td>41-50 Years</td>
<td>0.257 ± 0.005</td>
<td>0.229 ± 0.005</td>
<td>0.199 ± 0.006</td>
<td>0.309 ± 0.009</td>
<td>0.274 ± 0.009</td>
<td>0.241 ± 0.009</td>
</tr>
</tbody>
</table>
Total subjects recorded for ART in the age group 11-20 years are one hundred and fifty-three subjects out of which there are fifty-one controls, fifty-one smokers and fifty-one dipping tobacco users.

The average ± S.E ART for the control is 0.197 ± 0.009 Sec. The average ± S.E ART for the smokers is 0.008 Sec. The average ± S.E ART for the dipping tobacco users is 0.157 ± 0.006 Sec. are presented in table no 1 and graph 1.
As presented in table no.1 and graph no.2 ART values in control versus smokers of 11-20 years of age. The mean ± standard error for controls and smokers is 0.197 ± 0.009 and 0.185 ± 0.008 sec. The values of smokers are not significantly lower than control for the age group 11-20 years.

Graph 3
Are presented in table no. 1 and graph no.3 indicates the ART values in control versus dipping tobacco users of 11-20 years of age. The mean ± standard error for controls and dipping tobacco users are 0.197 ± 0.008 sec and 0.157± 0.006 sec. The values are significantly less in smoking group than control for the age group 11-20 years.

Graph 4

Table no.1 and graph no.4 indicates the ART values in smokers versus dipping tobacco users of 11-20 years of age. The mean ± standard error for smokers and dipping tobacco users are 0.185 ± 0.007 sec and 0.157 ± 0.006 sec. The values are significantly less in dipping tobacco users than smoking group for the age group 11-20 years.
Total subjects recorded for ART in the age group 21-30 years are one hundred and fifty-three subjects out of which there are fifty-one controls, fifty-one smokers and fifty-one dipping tobacco users.

The average ± S.E ART for the control is 0.207 ± 0.009 Sec. The average ± S.E ART for the smokers is 0.183 ± 0.007Sec. The average ± S.E ART for the dipping tobacco users is 0.157 ± 0.007 Sec. are presented in table no 1 and graph no 5.
Table no 1 and graph no.6 indicates the ART values in control versus smokers of 21-30 years of age. The mean ± standard error for controls and smokers is $0.207 \pm 0.009$ sec and $0.183 \pm 0.007$ sec. The values of smokers are significantly lower for the age group 21-30 years compared to control.
Table no.1 and graph no.7 indicates the ART values in control versus dipping tobacco users of 21-30 years of age. The mean ± standard error for controls and dipping tobacco users is 0.207 ± 0.009 sec and 0.157 ± 0.007 sec. The values of dipping tobacco users are significantly lower for the age group 21-30 years compared to control population.

Graph 8

The effect of tobacco on ART/sec between smokers and dipping tobacco users in the age group 21-30 years

Table no.1 and graph no.8 indicates the ART values in smokers versus dipping tobacco users of 21-30 years of age. The mean ± standard error for smokers and dipping tobacco users is 0.183 ± 0.007 sec and 0.157 ± 0.007 sec. The values of dipping tobacco users are significantly lower for the smoker age group 21-30 year.
Total subjects recorded for ART in the age group 31-40 years are one hundred and fifty-three subjects out of which there are fifty-one controls, fifty-one smokers and fifty-one dipping tobacco users.

The average ART ± S.E for the control is 0.235 ± 0.007 Sec. The average ART ± S.E for the smokers is 0.215 ± 0.008 Sec. The average ART ± S.E for the dipping tobacco users is 0.175 ± 0.007 sec. are presented in table no 1 and graph no 9.
Table 1 and graph no.10 represent ART values in control versus smokers of 31-40 years of age. The mean ± standard error for controls and smokers is 0.235 ± 0.007 sec and 0.215 ± 0.008 sec. The values of smokers are not significantly lower for the age group 31-40 years compared to control.
Table no.1 and graph no.11 represent ART values in control versus dipping tobacco users of 31-40 years of age. The mean ± standard error for controls and dipping tobacco users is 0.235 ± 0.007 sec and 0.175 ± 0.007 sec respectively. The values of dipping tobacco users are significantly lower than that of control for the age group 31-40 years.

Graph 12

Table no 1 and graph no.12 represents the ART values in smokers versus dipping tobacco users of 31-40 years of age. The mean ± standard error for smokers and dipping tobacco users is 0.215 ± 0.008 sec 0.175 ± 0.007 sec respectively. For the age group 31-40 years the value of dipping tobacco users are significantly lower as compared to smokers.
Total subjects recorded for ART in the age group 41-50 years are one hundred and fifty-three subjects out of which there are fifty-one controls, fifty-one smokers and fifty-one dipping tobacco users.

The average ± S.E ART for the control is 0.257 ± 0.005 Sec. The average ± S.E ART for the smokers is 0.229 ± 0.005 Sec. The average ± S.E ART for the dipping tobacco users is 0.199 ± 0.006 sec. are presented in table no 1 and graph no 13.
Table no.1 and graph no. 14 represents ART values in control versus smokers of 41-50 years of age. The mean ± standard error for controls and smokers is 0.257 ± 0.005 sec and 0.229 ± 0.005 sec respectively. The values of smokers are significantly lower for the age group 41-50 years as compared to control.
Table no.1 and graph no.15 shows ART values in control versus dipping tobacco of 41-50 years of age. The mean ± standard error for controls and dipping tobacco is 0.257 ± 0.005 sec and 0.199 ± 0.006 sec respectively. The values of dipping tobacco users are significantly lower for the age group 41-50 years compared to control.

Graph 15

The effect of tobacco on ART(sec) of smokers and dipping tobacco users in the age group 41-50 years

Table no.1 and graph no.16 represent ART values in smokers versus dipping tobacco of 41-50 years of age. The mean ± standard error for smokers and dipping tobacco is 0.229 ± 0.005 sec and 0.199 ± 0.006 sec respectively. The values of smokers are significantly lower for the age group 41-50 years compared to dipping tobacco users.
Total subjects recorded for VRT in the age group 11 to 20 are one hundred and fifty-three subjects out of which there are fifty-one controls, fifty-one smokers and fifty-one dipping tobacco users.

The average VRT ± S.E for the non-tobacco users is 0.267 ± 0.011 Sec. The average VRT ± S.E for the smokers is 0.253 ± 0.010 Sec. The average VRT ± S.E for the dipping tobacco users is 0.228 ± 0.010 Sec. are represent in table no. 1 and graph no.17.
Table no1 and graph no.18 shows VRT values in control versus smokers of 11-20 years of age. The mean ± standard error for controls and smokers is 0.267 ± 0.11 sec and 0.253 ± 0.010 sec respectively. The values of smokers are not significantly lower for the age group 11-20 years compared to control.
Table no.1 and graph no.19 depicts VRT values in smokers versus dipping tobacco users of 11-20 years of age. The mean ± standard error for controls and dipping tobacco users is 0.267 ± 0.010 sec and 0.228 ± 0.010 sec respectively. The values of dipping tobacco users are not significantly lower for the age group 11-20 years compared to control.

Graph 20

Table no. 1 and graph no. 20 shows VRT values in smokers versus dipping tobacco users of 11-20 years of age. The mean ± standard error for dipping tobacco users and smokers is 0.253 ± 0.019 sec and 0.228 ± 0.010 sec respectively. The values of dipping tobacco users are significantly lower for the age group 11-20 years compared to smokers.
Total subjects recorded for VRT in the age group 21 to 30 are one hundred and fifty-three subjects out of whom there are fifty-one controls, fifty-one smokers and fifty-one dipping tobacco users.

The average VRT ± S.E for the non-tobacco users is 0.281 ± 0.008 sec. The average VRT ± S.E for the smokers is 0.258 ± 0.006 sec. The average VRT ± S.E for the dipping tobacco users is 0.229 ± 0.008 sec. are represent in table no.1 and graph no.21.
Table no. 1 and graph no.22 shows of VRT values in control versus smokers of 21-30 years of age. The mean ± standard error for controls and smokers is 0.281 ± 0.008 sec and 0.258 ± 0.006 sec respectively. In the age group 21-30 years the values of smokers are significantly lower as compared to control.

Table no. 1

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Control (sec)</th>
<th>Smoking (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>21-30 YEARS</td>
<td>0.281</td>
<td>0.258</td>
</tr>
</tbody>
</table>

Graph 23

The effect of tobacco on VRT(sec) between control and dipping tobacco users in the age group 21-30 years

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Control (sec)</th>
<th>Dipp (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>21-30 YEARS</td>
<td>0.281</td>
<td>0.229</td>
</tr>
</tbody>
</table>
Table no.1 and graph no.23 represent VRT values in control versus dipping tobacco users of 21-30 years of age. The mean ± standard error for controls and dipping tobacco users is 0.281 ± 0.008 sec and 0.229 ± 0.008 sec respectively. The values of dipping tobacco users are significantly lower as compared to control in the age group 21-30 years.

Graph 24

The effect of tobacco on VRT(sec) between smokers and dipping tobacco users in the age group 21-30 years

VRT values in smokers versus dipping tobacco users of 21-30 years of age are presented in table no.1 and graph no.24. The mean ± standard error for smokers and dipping tobacco users is 0.258 ± 0.006 sec and 0.229 ± 0.008 sec respectively. As compared to smokers the value of dipping tobacco users are significantly lower for the age group 21-30 years.
Total subjects recorded for VRT in the age group 31-40 years are one hundred and fifty-three subjects out of whom there are fifty-one controls, fifty-one smokers and fifty-one dipping tobacco users.

The average VRT ± S.E for the non- tobacco users is 0.296 ± 0.007 sec. The average VRT ± S.E for the smokers is 0.264 ± 0.007 sec. The average VRT ± S.E for the dipping tobacco users is 0.237 ± 0.007 sec. are represented in table no.1 and graph no.25.
Table no.1 and graph no.26 represent VRT values in control versus smokers of 31-40 years of age. The mean ± standard error for controls and smokers are $0.296 \pm 0.007$ sec and $0.264 \pm 0.007$ sec respectively. The values of smokers are significantly lower as compared to control for the age group 31-40 years.
Table no.1 and graph no.27 represent VRT values in control versus dipping tobacco users of 31-40 years of age. The mean ± standard error for controls and dipping tobacco users is 0.296 ± 0.007 sec and 0.237 ± 0.007 sec respectively. For the age group 31-40 years the values of dipping tobacco users are not significantly lower for the age group 31-40 years as compared to control.

Graph 28

Tables no. 1 and graph no.28 represent VRT values in smokers versus dipping tobacco users of 31-40 years of age. The mean ± standard error for smokers and dipping tobacco users is 0.264 ± 0.007 sec and 0.237 ± 0.007 sec respectively. The values of smokers are significantly lower for the age group 31-40 years compared to dipping tobacco users.
Total subjects recorded for VRT in the age group 41 - 50 years are one hundred and fifty-three subjects out of whom there are fifty-one controls, fifty-one smokers and fifty-one dipping tobacco users.

The average VRT ± S.E for the non-tobacco users is 0.309 ± 0.009 sec. The average VRT ± S.E for the smokers is 0.274 ± 0.009 sec. The average VRT ± S.E for the dipping tobacco users is 0.241 ± 0.009 sec. are represent in table no.1 and graph no.29.
Table no. 1 and graph no. 30 shows VRT values in control versus smokers of 41-50 years of age. The mean ± standard error for controls and smokers is 0.309 ± 0.009 sec. and 0.274 ± 0.009 respectively. For the age group 41-50 years the values of smokers are not significantly lower as compared to control.

Graph 31

The effect of tobacco on VRT(sec) between control and dipping tobacco users in the age group 41-50 years
Table no.1 and graph no.31 represent VRT values in control versus dipping tobacco users of 41-50 years of age. The mean ± standard error for controls and dipping tobacco users 0.309 ± 0.009 sec to 0.241 ± 0.009 sec respectively. In the age group 41-50 year, as compared to control group dipping tobacco users are significantly lower VRT value.

Graph 32

The effect of tobacco on VRT(sec) between smokers and dipping tobacco users in the age group 41-50 years

VRT values in smokers versus dipping tobacco users of 41-50 years of age are presented in Table no. 1 and graph no.32. The mean ± standard error for smokers and dipping tobacco users is 0.274 ± 0.009 sec to 0.241 ± 0.009 sec respectively. For the age group 41-50 years values for dipping tobacco users are not significantly lower as compared to smokers.
### DISCUSSION

<table>
<thead>
<tr>
<th>Age group</th>
<th>Control versus smokers</th>
<th>Smokers versus dipping tobacco users</th>
<th>Smokers versus dipping tobacco users</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-20 years</td>
<td>Non Significant</td>
<td>Significant</td>
<td>Significant</td>
</tr>
<tr>
<td>21-30 years</td>
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<td>Significant</td>
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</tr>
<tr>
<td>31-40 years</td>
<td>Non Significant</td>
<td>Significant</td>
<td>Significant</td>
</tr>
<tr>
<td>41-50 years</td>
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<table>
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<tr>
<th>Age group</th>
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<th>Smokers versus dipping tobacco users</th>
<th>Smokers versus dipping tobacco users</th>
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<tbody>
<tr>
<td>11-20 years</td>
<td>Non Significant</td>
<td>Non Significant</td>
<td>Significant</td>
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<tr>
<td>21-30 years</td>
<td>Significant</td>
<td>Significant</td>
<td>Significant</td>
</tr>
<tr>
<td>31-40 years</td>
<td>Significant</td>
<td>Non Significant</td>
<td>Significant</td>
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<tr>
<td>41-50 years</td>
<td>Significant</td>
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</tbody>
</table>
**ART**

(i) There is a significant decrease in ART for dipping tobacco users as compared to control and smokers.

(ii) All age groups differ significantly from each other.

(iii) ART decreases with age in each group of control, smokers and dipping tobacco users.

(iv) ART is lowest for dipping tobacco users smokers and control subjects in each age group.

**VRT**

(i) There is a significant decrease in VRT for dipping tobacco users as compared to control and smokers.

(ii) All age groups differ significantly from each other.

(iii) VRT decreases with age in each group of control, smokers and dipping tobacco users.

(iv) VRT is lowest for dipping tobacco users smokers and control subjects in each age group.

In the present study reaction to sound (ART) is found to be faster than reaction to light (VRT). The ART being 157 to 257 ms and VRT being 228 to 309 ms. Perhaps this is because an auditory stimulus only takes 8-10 ms to reach the brain (Kemp – 1973) where as a visual one takes 20 – 40 ms (Marshal et al 1943). Jing-Long Wu et al (1999) reported that the strongest response is to visual stimulus and is in the Broadman’s area 39, while the activation of the left partial lobe is observed from the auditory stimulus.
Many research workers Woodworth and Shcoloberg (1954) Von Fieandt et al (1956) Brebner (1980) confirmed that reaction to sound is faster than reaction to light.

In all the age groups reduction in ART and VRT are observed in smokers and dipping tobacco users, as compared to control. 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 (Borkar and Padnekar, 2003). The stimulating action of nicotine on human nervous system and shortening or reaction time has been reported by Bell (1968), Myrsten et al (1968), Armitage et al (1974), Russell et al (1974), Wesries and Warburton (1983), Hauser et al (1988), Revell (1988), Ichaporia et al (1991), Pomerleau (1992), Bates et al (1994).

Literature suggests that nicotine in the quantities taken by a human smoker can be a central nervous stimulating drug. Glad and Sundaramarthy (2012) 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/nor adrenaline release and greater amount of dopamine decrease in the central nervous system:

Pomerleau (1992) reported that increase in adrenaline/nor adrenaline and greater amount of dopamine favourably modifies cognitive demands which in turn elicit or enhance "pleasure". Bates et al (1994) reported that nicotine acts as psycho active drug able to
act at many sites in both the central and the peripheral nervous system.

Nikam and Gadkari (2012) reported that audio and visual reaction time were significant higher in older individuals 65-75 years as compared to younger 18-20 years, VRT were significant higher in older individuals than in younger individuals. ART were also significantly higher in old individuals than young Individuals.

Though the review of literature shows a common observation but nature of slow down is not very clear.

All the component of reaction time: the mental processing time to perceive a signal and to decide upon a response, 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 (Cerella 1985) 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 (Marsh and Geel 2000) Bunce et al (2004) reported that RT is quickest for young adult and gradually slows down with age.

Jadhao et al (2013) showed that delayed reaction time was more significant in higher age groups. As age advances smoking related changes in the auditory and visual reaction time also go on increasing. The probable explanation for this finding is that, as the age increases various changes occur in nerves e.g. increased fibrosis, segmental demyelization and degeneration leading to slowing of
conduction velocity in motor nerves. These changes are more prominent beyond 50 years of age with advancing age there is also an age related decline in psychomotor speed leading to delayed response in elderly individuals. (Houx and Jolles 1993)

Chandak and Makwana (2012) evaluated the effect of advancing age on visual and auditory reaction time in volunteers divided in age group of 21-45 years and another group of 46-60 years of age. They observed a significant increase in visual reaction time and auditory reaction time with advance age. Miles (1931), Bellis (1933)

Results of this study are in conformity with the study of Obvist (1953), Crossman and Szafran (1956), Griew (1959), Suci et al(1960) and David (1960) who reported steady increase in reaction time as person ages.

According to Welford (1980) the reason of slowing of reaction time with advancing age is that older people tends to be more careful and monitor their responses more thoroughly.

Botwinick and Thompson (1966) hypothesised that this could be due to the fact that older people tend to look more at what they are doing and are more cautious in reacting to stimuli.

In the present study, the ART and VRT values increase in control, smokers and dipping tobacco users as age advance. In age groups 11-20 yrs and 21-30 yrs ART and VRT values do not differ significantly in control, smokers and dipping. However, decreasing trend is shown in smokers and dippers as compared to control.
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.

As regards ART values, age group 31-40 yrs differs significantly from age group 11-20 yrs and 21-30 yrs similarly age group 41-50 yrs differs significantly from age groups 11-20 yrs, 21-30 yrs and 31-40 yrs. Over the age groups, smokers and dipping tobacco users differ significantly from control.

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.

In each age group there is a decreasing trend in ART values from control to smokers and dipping. All the three groups differ significantly from each other. Control group is having the highest mean value while dipping has lowest mean value.

Mean VRT values in each age group for control, smokers and dipping tobacco users show decreasing trend from control but none of them is significantly different from one another.

Ichaporia et al (1991) reported a significant decrease in the ART and VRT values in smokers as compared to healthy controls of the same age group Myrsten et al (2010) and Bell (1968) also reported shortening of reaction time in smokers after smoking one cigarette.

Glad and Sundarmurthy (2012) studied the impact of nicotine on Art and VRT in non smokers control group and dipping tobacco users. There is significant decrease in ART and VRT values in dipping
tobacco users group. The decrease in reaction time shows that there is an alteration in the sensory motor performance. The decrease in ART and VRT values shows that there is an acceleration of the response to the stimulus.

The raise in the systems response is due to the excessive adrenaline/nor adrenaline release and greater amount of dopamine decrease in the central nervous system (Pomerleau and Pomerleau (1984).

Myrsten et al (2010) believed that this temporary surge in these neuro transmitters 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 greater.

Hauser et al (1988) reported that greater sympathetic activity a state of greater alertness reported in smokers is due to the nicotine.

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 (2013) reported that both auditory and visual reaction time were delayed in chronic smokers as compared to that in controls.

The alteration of the processing capability of central nervous system as reflected by the changes in auditory and visual reaction times
might be due to impaired perceptual motor co-ordination in chronic smokers.

Pomerleau (1992) reported that the effects of nicotine are centrally mediated. The impact of nicotine on the central nervous system is neuroregulatory in nature affecting biochemical and physiological functions. Dose dependent neuron transmitter and neuroendocrine effects occur as plasma nicotine levels rise when a cigarette is smoked. When nicotine is inhaled the neuron-regulatory effects are immediately available and the reinforcing effects of the drug are maximized.

Bates et al. (1994) reported that nicotine acts as psycho active drug able to act at many sites in both central and the peripheral nervous system. He 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.

Revell (1988) reported that smoking as few as two puffs or cigarette improved both correct detections and reaction time after smoking.

Russell et al. (1974), Armitage et al. (1974), Wesnes and Warburton (1983) reported improved visual Vigilance and auditory vigilance due to improved reaction time. Pomerleau and Pomerleau (1984) reported increase in circulation level of catecholamines as plasma nicotine levels rise. Epinephrine levels rise when cigarettes is smoked and nicotine also alters that bio availability or dopamine.
USDHHS (1988) reported that administration of nicotine via cigarette smoking maximizes that neuroregulatory impact of the drug. Inhaled nicotine undergoes rapid absorption with approximately 25% of the inhaled drug reaching the brain with 7 seconds.

Pomerleau et al (1992) reported that affective state of cognitive demands can be modified in a favorable or adaptive manner at least temporarily by nicotine stimulation. By increasing central dopminergic turn and increase in nor-epinephrine and β- endorphin can elicit or enhance pleasure.