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Original Research Article

Study of Audio - Visual Reaction Time in Chronic Smokers and Alcoholic Males

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Abstract: The consumption of alcohol and cigarette smoking is most common and serious problem, worldwide. Apart from various factors such as awakening, age, sex, left v/s right hand practice, number of stimuli, fasting and nutrition, reaction time is also affected by smoking and alcohol consumption. The aim of the present study is to measure and compare Auditory & Visual reaction time between study groups (smoker, alcoholic, smoker with alcoholic) and control group. The present study involves 360 subjects in the age group of 30-60 years, both smoker and alcoholic, recruited from medicine OPD from S.M.S Hospital, Jaipur (Rajasthan). Out of total 360 subjects: - 90 were smoker, 90 were alcoholic, 90 were smoker with alcoholic and 90 were control subjects. Data were statistically analyzed by student's unpaired t test, one way ANOVAs and post hoc turkey test. Visual reaction time (sec.) for red and green light increased significantly ($p < 0.05$) in alcoholics and smoker with alcoholics when compared with controls with left hand and with right hand visual reaction time for red and green light increased significantly ($p < 0.05$) in smoker with alcoholics and smokers. Further, Auditory reaction time (sec.) (for low and high pitch) is highest in smoker with alcoholic group but non-significant, for low pitch with both left and right hand. Alcohol decreases processing of information and both smoking and alcohol consumption affects audio-visual reaction time by several ways.
Keywords: Visual reaction time (VRT); auditory reaction time (sec.) (ART)

INTRODUCTION

Reaction Time

The time that a person takes to react to a stimulus is known as reaction time. It is determined by autonomous response to external stimulus. It is the meantime between presentation of stimulus and occurrence of desired response in a subject [1]. The sensori-motor relation, efficacy of an individual and, the processing capability of central nervous system can be measured by the reaction time [2].

SMOKING

The person who regularly smokes tobacco is known as smoker [3]. In adults most of diseases and deaths occurs due to smoking tobacco. Due to smoking every year more than 6, 00,000 people die in the age group of 25-69 years, in India [4]. Risk of many types of cancers, heart disease, strokes and emphysema has increased in smokers [5].

There is presence of adverse effects on different types of cognitive/ psychological functions due to tobacco smoking [6]. Processing capability of brain is involved in intellectual functions that can be tested by numerous tests like neuro-physiological and / or neuro-cognitive tests [7].

ALCOHOL

The consumption of alcohol is most common and serious problem, worldwide. It is consumed mostly in the form of ethanol but it is consumed in different forms also, containing different concentrations of alcohol such as – Beer (4% - 12%), Wine (10% - 15%), Rum (37.5% - 75%), and Whisky (40% - 55%) [8]. The aim of the present study was to measure and compare Auditory & Visual reaction time between study groups and control group.

MATERIAL AND METHODS

The present study was carried out in upgraded Department of Physiology, S.M.S Medical College & Hospital, Jaipur. The present study involves 360 males attendants (30-60 years) of patients recruited from medicine OPD from S.M.S Hospital, Jaipur. Subjects were divided into 4 groups and each group contains 90 males:-

Group (A) - non-alcoholic and non-smoker
Group (B) - smoker
Group (C) - alcoholic
Group (D) - alcoholic with smoker

STATISTICAL ANALYSIS:

The mean values of all variables of audio-visual reaction time were compared by using one way ANOVA and post hoc turkey test. Results were presented as Mean ± SD. All the statistical analysis was performed using SPSS Version 23 and Microsoft Excel 2007, using appropriate software, p value < 0.05 was taken as significant.

The subjects (group – B, C, D) smoking and consuming alcohol for more than 10 years were selected for the study. Smokers were selected according to their smoking history in terms of pack years (unit for measuring the amount, a person has smoked over a long period of time):-

a) Consuming cigarette one pack year
b) Consuming cigarette more than one pack year and
c) Consuming cigarette less than one pack year.

Pack year (unit that determines the number or total a person has smoked over a long period of time) was calculated by multiplying the number of packs of cigarettes smoked per day with the number of years a person has smoked.

Pack years = (packs of cigarettes smoked per day) × (number of years as a smoker).
(1 pack has 20 cigarettes) [9].

Alcoholic was selected according to safe units of alcohol as:

a. Consuming within safe units
b. Consuming more than safe units and
c. Consuming less than safe units

Units of alcohol will be calculated as follows:-
Unit = Volume of drink × ABV (alcohol by volume or % of alcohol) ÷ 1000

Institutional ethical committee clearance was obtained before starting the study. An informed consent was taken from all the subjects after explaining the study. All the parameters were measured after 24 hours of drinking alcohol [10].

Exclusion criteria: Subjects suffering from any acute and chronic illness, fasting, practicing meditation or yoga therapy or on placebo treatment and having any visual or auditory problem were excluded from the study.

Measurement of Different Parameters

Each group was evaluated for different parameters such as - Height (cm) and weight (kg), blood pressure (mmHg):- by sphygmomanometer, auditory reaction time (seconds) and Visual reaction time (seconds).

Measurement of Reaction Time

Reaction time was recorded with the help of "Audio-Visual reaction time apparatus" by medisystems. It had a resolution of 0.1 second and display accuracy of 100% being the pizeo electric crystal used for 100% accuracy of time. The apparatus has two modes of stimulus: Auditory and visual.

Reaction Time was measured with the subject sitting comfortably in a quiet and well lighted room. Visual and Auditory signals was given from front side of the subject. Auditory reaction time (sec.) was recorded for low pitch (frequency) and high pitch (frequency) sound stimuli and Visual reaction time was recorded for red and green light with both hands (Right & Left). As soon as the stimulus was perceived by the subject, he responded by pressing the response key or switch by the index finger as quickly as possible. The display indicated the response time in seconds. After familiarizing the subject with the apparatus and after practicing, three readings for each parameter were noted. Interval between the stimuli randomly varies from 2-5 seconds. The least reading out of three was taken as the value for reaction time for both Auditory and Visual.

These parameters were measured in study and control subjects, and then a comparison was made to assess the effect of alcohol and smoking on Reaction time (study groups — alcoholic, smoker, alcoholic with smoker and control group – non-alcoholic and non-smoker.

RESULTS

In the present study the mean±SD values of age (years) for control group and study group were 43.03±9.42 and 43.1±10.76 respectively. The mean±SD values of height (cm) for control group and study group were 167±7.24 and 166.36±6.58 respectively. The mean±SD values of weight (kg) for control group and study group were 66.57±13.15 and 65.00±11.26 kg respectively. The mean±SD values of BMI (kg/m^2) for control group and study group were 23.78±3.98 and 23.47±3.75 respectively. The mean±SD values of SBP (mmHg) for control group and study group were 123.96±6.86 and 125.11±7.64 respectively. The mean±SD values of DBP (mmHg) for control group and study group were 84.49±6.04 and 85.24±7.15 respectively. The mean±SD values of MBP (mmHg) for control group and study group were 97.64±5.9 and 98.53±6.94 respectively.

Table 1 shows that Mean±SD values of visual reaction time (sec.) for red light with left hand in control group (A) and study groups – B, C and D were found to be 0.23±0.04, 0.24±0.04, 0.31±0.04 and 0.40±0.06 and Mean±SD values of visual reaction time (sec.) for red light with right hand in control group (A) and study groups – B, C and D were 0.21±0.04, 0.23±0.04, 0.21±0.04 and 0.23±0.08. Mean±SD values of visual reaction time (sec.) for green light with left hand in control group (A) and study groups – B, C and D were 0.23±0.04, 0.24±0.04, 0.31±0.04 and 0.40±0.06 and Mean±SD values of visual reaction time (sec.) for green light with right hand in control group (A) and study groups – B, C and D were found to be 0.20±0.04, 0.22±0.04, 0.21±0.04 and 0.22±0.04.

Table 1: Comparison of Audio-Visual reaction time [sec.] (with right and left hand) in control and study groups subjects:

Parameters	Groups	N	Mean	Std. deviation	p value	Parameters	Groups	N	Mean	Std. deviation	p value
VRT (sec.) for red light with left hand	Control	90	0.23	0.04	0.00*	VRT (sec.) for red light with right hand	Control	90	0.21	0.04	0.00*
	Smoker	90	0.24	0.04			Smoker	90	0.23	0.04	
	Alcoholic	90	0.31	0.04			Alcoholic	90	0.21	0.04	
	Smoker with alcoholic	90	0.40	0.06			Smoker with alcoholic	90	0.23	0.04	
VRT (sec.) for green light with left hand	Control	90	0.23	0.04	0.00*	VRT (sec.) for green light with right hand	Control	90	0.20	0.04	0.00*
	Smoker	90	0.24	0.04			Smoker	90	0.22	0.04	
	Alcoholic	90	0.31	0.04			Alcoholic	90	0.21	0.04	
	Smoker with alcoholic	90	0.40	0.06			Smoker with alcoholic	90	0.22	0.04	
ART (sec.) for low pitch with left hand	Control	90	0.18	0.20	0.66	ART (sec.) for low pitch with right hand	Control	90	0.17	0.04	0.08
	Smoker	90	0.18	0.06			Smoker	90	0.18	0.04	
	Alcoholic	90	0.17	0.09			Alcoholic	90	0.16	0.04	
	Smoker with alcoholic	90	0.19	0.04			Smoker with alcoholic	90	0.65	3.09	
ART (sec.) for high pitch with left hand	Control	90	0.17	0.04	0.17	ART (sec.) for high pitch with right hand	Control	90	0.17	0.03	0.21
	Smoker	90	0.18	0.04			Smoker	90	0.18	0.04	
	Alcoholic	90	0.17	0.04			Alcoholic	90	0.17	0.04	
	Smoker with alcoholic	90	0.18	0.08			Smoker with alcoholic	90	0.17	0.04	

(N= no. of subjects) ($p<0.05$ significant)*

Mean±SD values of auditory reaction time (sec.) for low pitch with left hand in control group (A) and study groups –B, C and D were found to be 0.18±0.20, 0.18±0.06, 0.17±0.09 and 0.19±0.04 and Mean±SD values of auditory reaction time (sec.) for low pitch with right hand in control group (A) and study groups – B, C and D were 0.17±0.04, 0.18±0.04, 0.16±0.04 and 0.65±3.09. Mean±SD values of auditory reaction time (sec.) for high pitch with left hand in control group (A) and study groups – B, C and D were 0.17±0.04, 0.18±0.04, 0.17±0.04 and 0.18±0.08 and Mean±SD values of auditory reaction time (sec.) for high pitch with right hand in control group (A) and study groups – B, C and D were found to be 0.17±0.03, 0.18±0.04, 0.17±0.04 and 0.17±0.04.

DISCUSSION

Reaction Time

Reaction time is an easy method and can be used as an index of cortical arousal, also important for efficient response to environment [11]. In the marine, aviation and road transport, visual stimuli like flashing are used as a signal coding method and in industrial environment, auditory modality is used. These input or output modalities are also found in many industrial application systems (to provide alertness) like design of driving vehicle, military communication, smoke detector alarm and light control system [12]. In the present study there was statistically no significant difference in the mean values of age, height, weight, body mass index, systolic blood pressure, diastolic blood pressure and mean blood pressure between control and study groups, thereby showing proper matching of controls and study group subjects. So these groups (study and control) are comparable for the study.

In this study visual reaction time (sec.) for red and green light increases significantly in alcoholics and smoker with alcoholics when compared with controls with left hand and with right hand visual reaction time (sec.) for red and green light increases in smoker with alcoholics and smokers. The result of the present study further revealed that auditory reaction time (sec.) for low and high pitch with left and right hand were statistically non-significant. Auditory reaction time (sec.) (for low and high pitch) is highest in smoker with alcoholic group but non-significant, for low pitch with both left and right hand.

So the results of this study for visual reaction time (red and green light) are in accordance with the findings observed by Phatale SR and Boramma S in 2014 [13], Kumar LR and Shenoyk C in 2009 [14], Katherine T and Stough C in 2000 [15], Maylor EA and Rabbitt PMA in 1987 [16], Gufatson R in 1986 [17], Antebi D *et al.;* in 1982 [18], Turen U *et al.;* in 2013 [19], Vallath A *et al.;* in 2015 [20] and Jadhao P *et al.;* in 2013 [21].

Our results do not corroborates (for visual reaction time) with the findings of Afshan A *et al.;* in 2012 [22], Ichapuria RB *et al.;* in 1991 [23], Morgan SF and Pickens RW (1982) [24] and Fay PJ in 1936 [25]. The possible reason for increase in ART and VRT in alcoholics may be that, sensory and motor both pathways are involved in reaction time. The sensory pathway includes the input of both visual and auditory signals which are sensed by the sensory receptors and carried by the optic and auditory nerve and information processing takes place in the brain. Motor pathway includes the cranial nerves and the nerves which supply the muscles of hand. In person with good reflexes, the processing of information is shorter, so reaction time is shorter. Both autonomic and peripheral nerves damage occur in alcoholics. Thus, decrease speed of the impulse conduction leads to increase in reaction time in neuropathies [14].

The possible reason for increase in ART and VRT due to smoking may be as follows: In smokers along with reduction in small airways function, PaO_2 and $PaCO_2$ also decrease [26]. Cerebral blood flow decreases due to hypocapnia (as CO_2 is most potent cerebral vasodilator). Cigarette smoke contains one harmful and neurotoxic substance carbon monoxide, so chronic smokers develop an increased carboxyhaemoglobin level that affects oxygen transport and its utilization, in this way it might cause impairment of function of central nervous system. Thus, cognitive dysfunction and perceptual-motor delay occurs in habitual smokers, due to decreased cerebral blood flow and hypoxic impairment of central nervous system [27].

CONCLUSION

Alcohol decreases processing of information and so it is hazardous while driving and also decreases performances in many motor tasks like writing, drawing and typing. This will be useful to share this information to enable the alcoholics towards positive thinking.

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