International Journal of Research in Medical Sciences
Kaur V et al. Int J Res Med Sci. 2016 Nov;4(11):4812-4815
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012

DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20163771

Original Research Article

A comparative study of information processing time in chronic alcoholic and non-alcoholic men

Vishavdeep Kaur*, Lily Walia, Simran Grewal, Sangeeta Nagpal

Department of Physiology, Maharishi Markandeshwar Medical College and Hospital, Solan, Himachal Pradesh, India

Received: 24 August 2016
Revised: 30 September 2016
Accepted: 01 October 2016

***Correspondence:**
Dr. Vishavdeep Kaur,
E-mail: drvishavdeepurv@gmail.com

ABSTRACT

Background: An impairment in information processing time in chronic alcoholics compared to non-alcoholic men. Information processing time was assessed by using reaction time as a tool. Reaction time involves the central processing to a sensory input and output as execution of movement which may be a success or failure.
Methods: Chronic alcoholics were diagnosed on the basis of AUDIT, extensive history and complete examination. Reaction time a tool for assessing information processing time was measured using digital display response time apparatus with a visual stimulus.
Results: Visual reaction time for all three colours was increased in chronic alcoholics compared to the non-alcoholic men.
Conclusions: This study concludes that with chronic consumption of alcohol there is slow processing of information as well as decrease in efficiency of sensorimotor functioning which is shown by an increased reaction time for visual stimuli.

Keywords: Chronic alcoholics, Information processing time, Sensorimotor functions

INTRODUCTION

Impairment in information processing after alcohol administration has been demonstrated in past research studies. Results of these studies showed that increased alcohol concentration causes impairment in different stages of information processing. While performing any action after a stimulus the event includes reaction time (RT), vigilance and cognition.[1] But these studies were done after acute alcohol intoxication and a very few studies have reported the effect of chronic alcohol intake on information processing time. The purpose of this paper is to try to fulfill the gap and to assess what chronic alcoholism does to total information processing. The information processing for a stimulus includes Input in form of sight, feel, smell or taste which is sensed by respective sense organ and selectively transforms the relevant information in the cerebral cortex. After central processing, a decision is made and a motor program is initiated. According to the commands from the centre, movement is produced as muscle contraction and resultant action is performed which may result in success or failure.[2]

The early stages of information processing are described by detection of the stimuli and response to that stimulus, whereas total information processing time is given by reaction time which involves total decision making time and response oriented measures. Reaction time is the time interval between the stimulus onset and response. This all is done under condition that the subject responds as rapidly as possible when the stimulus is provided. The result thus provides information about the integrity and processing ability of the central nervous system.[3] The

speed with which a person reacts to a stimulus involves time to: activate the sensory receptor activation; transmission of impulses from sense organ to brain; processing of impulses in brain; transmission of impulses from brain to concerned muscle; energization and activation of muscles; execution of movement.

The time for reaction includes steps or processes that are independent of each other and also the time taken to process the information collected by the sense organs till processing by brain. Each of the step and process receives input from the preceding stage and a particular translation or transformation of the received information is done. The output hence received from each stage after processing is then passed along to the next step for further action. Each step in the information processing sequencing produces a particular transformational effect. That is, there is a variation in the transformation that is occurring at each step as the input to each stage is different varying from trial to trial and hence the transformation applied to any input can never be same at that point in the sequence. The output finally achieved will have particular level of information processing different for each trial of stimulus.[4] The purpose of a stage is to produce a constant informational transformation. This transformation of information or processing can be assessed by various methods among which reaction time has been used as a reliable indicator. Reaction time is an indirect index of this processing capability of CNS and also a means of determining sensorimotor performance. Thus in present study we used reaction time with a visual stimuli for assessing total information processing time in chronic alcoholic and nonalcoholic men.

METHODS

A total number of 60 subjects were selected from gastroenterology OPD and ward, DMC Hospital Ludhiana, Punjab, India. Approval for study was taken from institutional ethical committee. The subjects were divided into two groups study and control, each group comprising of 30 subjects. The study group comprised of chronic alcoholics and the control group consisted of apparently healthy nonalcoholic men. Diagnosis of alcoholism was based on detailed history including information of daily intake, frequency and duration of alcohol intake. A complete clinical examination was done. Subjects were diagnosed as chronic alcoholics on basis of alcohol use disorder screening test (AUDIT).[5] Subjects showing alcohol dependent withdrawal symptoms or physical signs and symptoms that were useful in identifying alcoholism i.e. mild and fluctuating hypertension, repeated infections etc. were also included in the study group. Subjects suffering from any clinical disease likely to affect retina, visual pathway or abnormal vision, having any other addiction, hepatic encephalopathy or head injury. Patients on drugs known to produce adverse effect on visual system were excluded from the study group.

The purpose, procedure and noninvasive nature of the study were explained and written informed consent was taken from each subject. In various past studies reaction time has been used as a reliable tool for assessing total information processing time.[2] Hence we used reaction time using a visual stimulus to assess the total information processing time in chronic alcoholic and nonalcoholic men. Visual reaction time (VRT) was recorded using digital display response time apparatus (Model No. RTM 608. Medicaid: Ambala) equipped with three visual stimuli (red, yellow and green lights).[6] All the subjects were thoroughly acquainted with the apparatus and three practice sessions were given to every subject before taking the reading to help them get conversant with the procedure.

The subject was presented randomly with one of the three visual stimuli by the observer and subject responded by pressing the knob of digital display apparatus to switch off the produced light. Reaction time displayed on apparatus in milliseconds was recorded. Lowest of three readings was considered for each stimulus. Reaction time was reported as mean ±SD. The reaction time thus obtained gives the total duration of information processing after a visual stimulus has been given. Mean and standard deviation was computed. The comparison of means was done by using unpaired t - test.

RESULTS

Table 1 and Figure 1-3 shows the comparison of VRT-red, yellow and green in milliseconds of subjects in study group and control group. The mean±SD of VRT-red, green and yellow in study group was statistically significant as compared to control group.

Table 1: VRT in study and control groups, comparison of VRT between study and control groups.

Variable	study group (mean±SD)	Control group (mean±SD)	T value	P value
Red	153.11±84.33	54.64±10.22	6.35	0.0001[xxx]
Yellow	149.93±54.24	127.38±12.48	4.09	0.001[x]
Green	133.56±107.86	52.28 ±9.14	4.11	0.0001[xx]

[x]significant; [xx] Highly significant.

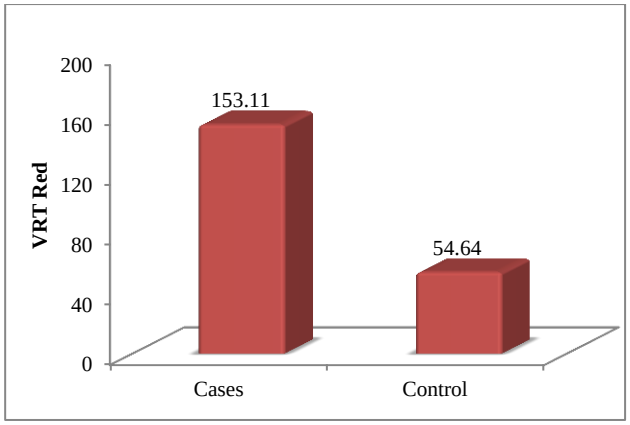

Figure 1: VRT red among study and controls.

Figure 1 shows the comparison of VRT-red in milliseconds of subjects in study group and control group.

The mean of VRT-red in study group subjects was 153.11 and SD was 84.33 which were much higher than the mean of VRT-red in control group subjects which was 54.64 with SD value of 10.22. The t-value was 6.35 and a very significant p-value 0.0001.

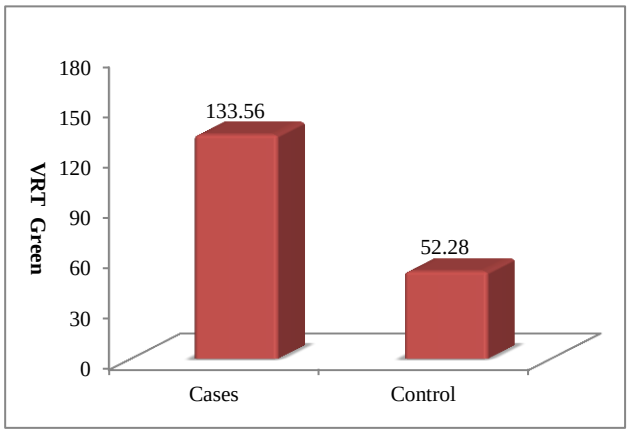

Figure 2: VRT green among study and control.

Figure 2 shows the comparison of VRT –green in milliseconds on subjects in study and control group.

The mean of VRT- green in study group was 133.56 and SD was 107.86 which were much higher than the mean of VRT –green in subjects of control group which was 52.28 with SD value of 9.14. The t-value was 4.11 and a very significant p-value 0.001.

Figure 3 shows the comparison of VRT –yellow in milliseconds of subjects in study and control group. The mean of VRT- yellow in control group was 149.93 and SD was 12.48 which were much higher than the mean of VRT –yellow in subjects of control group which was 54.24 with SD value of 12.48. The t-value was 4.09 and a very significant p-value 0.001.

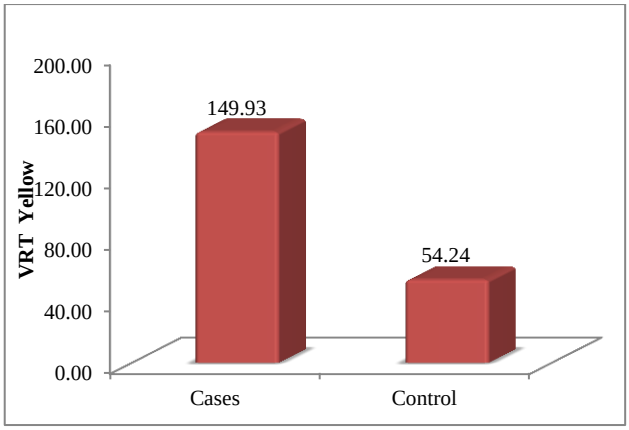

Figure 3: VRT yellow among study and controls.

DISCUSSION

When the pattern of alcohol use is such that there is an increase in the risk of harmful consequences for the person himself or to others, then condition is called as hazardous pattern of drinking. On the other hand, when alcohol consumption results in negative physical and mental health consequences, such drinking pattern is called as harmful drinking. The social consequences are often included among the harms caused by alcohol.[7]

Thus this study was done to see the harmful consequences of prolonged use of alcohol on CNS, which in our study was shown as slowed information processing time assessed by reaction time. This further proves that with chronic consumption of alcohol there occurs a delay in processing of CNS and co- ordination between sensory and motor functions. Results similar to our study have indicated the adverse effect of alcohol on CNS.[8-9] Slowing of motor command because of delay in decision making process is seen in chronic alcoholics as a result of lesions in anterior areas of brain.

During processing of visual information, there is a simultaneous activity of both cerebral hemispheres but in chronic alcoholics this processing in cerebral cortex is disturbed. Along with it alcoholics also suffer from alcoholic amblyopia which is vision dimness or partial loss of sight with or without any observable lesion in the layers and structure of eye or in the optic nerve. This all may be a result of malnutrition associated with chronic alcoholism or a direct effect of alcoholic metabolites.[10] This all results in an increased reaction time in chronic alcoholics

In addition to this, involvement of cerebellar hemispheres further decreases the capacity of information processing as well as shows impairment in perceptual motor coordination, which all again contributes to delayed response and an increased reaction time in chronic alcoholics. Excessive and prolonged use of alcohol as seen in chronic alcoholics has shown to cause a pattern of damage in central nervous system which is characterized

by brain shrinkage as there is decrease in cerebral white matter and grey matter as well as extensive cerebellar degeneration.

In another study it was revealed that alcohol causes inhibition of ongoing genesis of neurons and glia, resulting in brain / tissue loss or neurodegenration.[11] Studies have also shown that with chronic consumption of alcohol there is an increase in lipid peroxidation products and a decrease in antioxidant factors with its related enzymes which can eventually induce apoptosis mediated cell death.[12] All these degenerative changes causes an increase in reaction time because of increased duration of information processing in cerebral cortex with delayed programming and timing by cerebellar cortex for any motor movement.

CONCLUSION

Though consumption of alcohol has long been part a of everyday life in the society, it can be concluded from the results of this study that exposure to chronic alcohol is harmful for the health of an individual especially to the sensorimotor functioning. The results of our study further solidify the fact that alcohol misuse is a serious risk factor for increased morbidity and mortality. But this study still has limits as the effect could not be correlated with the duration and the amount of alcohol consumed and requires more research with more number of subjects along with evoked potentials.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Maylor EA, Rabbitt PM, James GH, Kerr SA. Effects of alcohol and extended practice on divided-attention performance. Perception and Psychophysics. 1990;48:445-52.
2. Pachella RG. The interpretation of reaction time in information-processing research. In B. H. Kantowitz (Ed.) Human information processing: Tutorials in performance and cognition. Hillsdale, NJ. Lawrence Erlbaum Associates. 1974;41-82.
3. Hyman R. Stimulus information as a determinant of reaction times. J Experi Psychol. 1953;45:188-96.
4. Ulrich R, Miller J. Effects of truncation on reaction time analysis. J Experi Psychol, General. 1994;123:34-80.
5. Saunders JB, Aasland OG, Babor TF, de la Fuente, JR, Grant M. Development of the Alcohol Use Disorders Identification Test (AUDIT):WHO collaborative project on early detection of persons with harmful alcohol consumption. II. Addiction. 1993;88:791-804.
6. Patel M, Singh SK. Effect of pregnancy on visual reaction time. J Obstet and Gynecol India. 2006;56(5):410-2.
7. Marshall H. Alcohol:a critical review of the literature 1929-1940. Psychological Bulletin. 1941;38(4):193-217.
8. Maylor EA, Rabbitt PM, James GH, Kerr SA. Effects of alcohol, practice and task complexity on reaction time distributions. Quan J Exper Psy. 1992;44:119-39.
9. Maylor EA, Rabbitt PM, James GH, Kerr, SA. Effects of alcohol and extended practice on divided-attention performance. Perception and Psychophysics. 1990;48:445-52.
10. Gustafson R. Alcohol and vigilance performance: effect of small doses of alcohol on simple visual reaction time. Perception and Motor Skills. 1996; 62:951-5.
11. Oscar-Berman M. Alcoholism and the brain: an overview. Alcohol Research and Health. 2003;27(2):125-33.
12. Marmot MG, Shipley MJ, Rose G, Thomas BJ. Alcohol and mortality: a U-shaped curve. Lancet. 1981;1:580-3.

Cite this article as: Kaur V, Walia L, Grewal S, Nagpal S. A comparative study of information processing time in chronic alcoholic and non-alcoholic men. Int J Res Med Sci 2016;4:4812-5.