Research Article

BIOMEDICAL Journal of Scientific & Technical Research

ISSN: 2574 -1241

DOI: 10.26717/BJSTR.2026.66.010347

Features of the Manifestation of Oculomotor Reactions in Men with Alcohol Dependence: An Exploratory Study

Yulia A Shatyr*, Daniil V Moiseev, Irina V Ulesikova and Alexander B Mulik

S.M. Kirov Military Medical Academy, St. Petersburg, Russia

***Corresponding author:** Yulia A Shatyr, Candidate of Biological Sciences, Docent, Senior Researcher, Research Department of Medical and Biological, Research Center, Kirov Military Medical Academy, St. Petersburg, Russia

ARTICLE INFO

Received: July 20, 2026

Published: August 19, 2026

Citation: Yulia A Shatyr, Daniil V Moiseev, Irina V Ulesikova and Alexander B Mulik. Features of the Manifestation of Oculomotor Reactions in Men with Alcohol Dependence: An Exploratory Study. Biomed J Sci & Tech Res 66(3)-2026. BJSTR. MS.ID.010347.

ABSTRACT

Eye-tracking technology is based on tracking gaze direction and eye movement activity in humans. The aim of the study was to evaluate the potential of eye tracking using non-alcohol related visual objects to assess men's propensity to consume alcohol. A Gazepoint GP3 eye tracker (Canada) was used to assess oculomotor responses. The study revealed that using images with opposing emotional and semantic modalities expands our understanding of the structure of oculomotor responses in individuals who consume alcohol. It was found that the number of fixations before the first fixation on a positive area of interest and the time before the first fixation on a positive area of interest were statistically significantly ($p<0.01$) higher in men who consumed alcohol than in men who did not consume alcohol.

Keywords: Alcohol Dependence Screening; Eye-Tracking; Oculomotor Reactions

Introduction

According to the WHO, alcohol is one of the main factors causing premature mortality among the world's population. Alcohol consumption causes 3 million deaths annually [1]. Identifying individuals at risk of harmful alcohol consumption using traditional questionnaire screening methods in primary health care is characterized by low efficiency, including due to censoring of consciousness when answering problematic questions [2]. With the development of methods for instrumental assessment of the body's involuntary reactions to the presentation of stimulus material, the possibilities for automated detection of alcoholism symptoms have increased significantly. Eye-tracking technology, based on tracking human gaze and eye movement activity, is most frequently used. Some studies have demonstrated selective attention in individuals with alcohol dependence to visual information, favoring cues associated with alcohol and intoxication-related behavior [3]. At the same time, there is evidence that individuals with alcohol dependence avoid attention to alcohol-related stimuli after comprehending the meaning of visually presented information [4]. The presented data, firstly, confirm the feasibility of using eye tracking for screening alcohol dependence in men, and secondly, substantiate the need to search for new visual objects that are not associated with alcohol, but reflect a person's tendency to demand adaptogens.

Objective Of the Study

To evaluate the potential of eye tracking using non-alcohol related visual objects to assess men's propensity to consume alcohol.

Materials and Methods

The study involved 39 Caucasian men aged 19-26 years, living in St. Petersburg. All studies were conducted in accordance with the principles of the Universal Declaration on Bioethics and Human Rights, in particular Articles 4 (benefits and harms), 5 (autonomy and individual responsibility), 6 (consent), and 9 (privacy and confidentiality). All participants provided informed consent prior to inclusion in the study. The study was approved by the Ethics Committee of the Kirov Military Medical Academy (St. Petersburg, Russia), Protocol No. 295 dated October 22, 2024. Using the AUDIT-C method, the absence (< 4 points) or presence (≥ 4 points) of alcohol dependence was determined in the subjects through anonymous testing. The group of

people without alcohol dependence included 14 men, and the group with alcohol dependence included 25 men. To assess oculomotor responses, a Gazepoint GP3 eye tracker (Canada) was used, along with the Neurobureau hardware and software system from Neuroiconics Assistive (Russia). The stimulus material was presented on a 15" laptop with a screen resolution of 1920x1080 pixels (Figure 1). The subject's face was positioned 60-70 centimeters from the screen. Key eye-tracking parameters were recorded: duration (seconds) and number of fixations, number of saccades, scan path length (angular degrees), and number of returns to the area of interest. The subjects' psychosomatic status was assessed using the Giessen Somatic Complaint Questionnaire. Statistical analysis of the data was performed using the Mann-Whitney U test. To address differential diagnostic issues, a model was developed using discriminant analysis and the canonical linear discriminant function.

Figure 1: Marking of stimulus material.

Results

Based on the results of the theoretical stage of the study, indirect approaches to modeling oculomotor reactions were identified as independent of voluntary control associated with the actual test subject. The key principle in compiling the visual stimulus was dividing the screen into a left and right field, with differentiated emotionally positive and emotionally negative content of the image, respectively. In a similar study by [5], alcohol and a flower, or a face and a vehicle, were displayed on the left and right sides of the screen [5]. Subjects were asked to perform a saccade as quickly as possible in the direction of a given stimulus (either alcohol, a flower, a face, or a vehicle). When the target stimulus was a face, alcohol-dependent subjects responded to it more quickly and less consciously than when the target stimulus was an image of alcohol. Alcohol-dependent subjects, when the target stimulus was a flower, showed a weaker tendency to shift attention after an erroneous saccade to the alcohol stimulus. To enhance the emotional component of stimulus perception, a drawing by T. Storino, publicly available on the Behance website (https://www.behance.net/gallery/5813399/Life-or-Death?locale=ru_RU), was used for the subsequent experimental stage of the study. The duration of the added stimulus image display is programmed in the Creator software (15,000 ms). The image size is 1280x770 pixels in jpg format. The image depicts a landscape with elements of flora and fauna, divided into two halves in the center. The left half of the image is filled with bright, high-intensity colors, which evokes positive feelings and emotions. The right half of the image is a parched desert, painted in gray and gloomy shades, as well as semantic content (bones, scavengers), which evokes negative emotions and sensations. Then, in the Analyzer program, the left and right areas of interest are marked on the image in a 50/50 ratio, and the analyzed eye tracking indicators are taken into account. The results of the experimental stage of the study are presented in (Table 1).

Table 1: Expression of basic eye-tracking indicators in groups of non-drinking and drinking men.

Indicators	Groups	
	Non-drinkers	Drinkers
	(M±m)	(M±m)
Number of fixations before first fixation on a positive area of interest	0±0	0,02±0,008***
Time to first fixation on a positive area of interest (sec)	0±0	0,0014±0,0004***
Time to first fixation on a negative area of interest (sec)	0,96±0,44	1,56±0,2*
Total viewing time on a positive area of interest (sec)	8,45±0,64	8,10±0,025
Total viewing time on a negative area of interest (sec)	4,99±0,55	5,98±0,41
Average fixation duration on a positive area of interest (sec)	0,32±0,03	0,36±0,03
Average fixation duration on a negative area of interest (sec)	0,32±0,04	0,35±0,02
Total number of fixations on a positive area of interest	28,6±3,04	23,2±1,19*
Total number of fixations on a negative area of interest	17,7±2,04	18,3±1,3
Total number of saccades on a positive area of interest	21,64±2,7	16,61±0,86***
Total number of saccades on a negative area of interest	11,37±1,3	12,52±1,25
Total scan path length of a positive ROI (angular degrees)	92,9±7,17	72,3±3,67**

Note: * – at p<0.1 (trend level); ** – at p<0.05; *** – at p<0.01.

In order to determine the diagnostic capabilities of taking into account the indicators that differ most (p<0.01) between representatives of the study groups, in order to assess a person's tendency to alcoholism, a discriminant analysis of the obtained data was carried out with the development of a canonical linear discriminant function model. The overall sensitivity of the decision rules was 69.4% for all observations. For the group of individuals who do not consume alcohol, the sensitivity was 22.2%, while for alcohol consumers it was 93.1%. The analysis resulted in a model (the inclusion parameter (F-enter) is equal to 2, the exclusion parameter (F-remove) is equal to 1.9), which included two indicators: the total number of fixations on the positive region of interest and "headache", which amounted to 1.301 units in the group of men consuming alcohol, and 0.902 units in the group of men who do not consume alcohol (Table 2). An equation (Y = -5.558 + 0.049X1 – 0.682X2) was then developed to solve the problems of determining the propensity to consume alcohol using the specified parameters (Table 3).

Table 4 shows the centroid coordinates for solving the differential diagnosis problem.

Table 2: Information content of indicators within the linear discriminant function.

Indicators	Wilks' Lambda	Partial	F-remove	p-value	Toler.	1-Toler.
Total number of fixations on a positive area of interest	0,86	0,96	4,22	0,04	0,93	0,07
Headache	0,87	0,95	5,49	0,02	0,98	0,02

Table 3: Standardized coefficients of the diagnostic canonical linear discriminant function.

Indicators		Root 1
X1	Total number of fixations on a positive area of interest	0,049
X2	Headache	-0,682
Constant		-5,558
Eigenval		0,211
Cumulative Proportion		1

Table 4: Centroid coordinates for solving the differential diagnosis problem.

Indicators	Root 1
Total number of fixations on a positive area of interest	0,643
Headache	-0,322

Discussion

An analysis of differences in baseline eye-tracking parameters between the drinking and non-drinking groups (Table 1) revealed several key findings. Thus, compared to non-drinking men, the group of men who drink alcohol showed less interest in studying positively charged images, devoting less time (total time viewing the positive area of interest) and effort (total number of fixations, saccades, and total scan path length on the positive area of interest) to viewing them than did viewing negative images. Further support for this assertion is the statistically significant predominance of the number of fixations prior to the first fixation on the positive area of interest and the time to first fixation on the positive area of interest in the group of male drinkers. Men who consumed alcohol demonstrated a longer overall viewing time for the negative image (total viewing time for the negative area of interest), a greater number of fixations (total number of fixations on the negative area of interest), and a longer duration of fixations (average fixation duration on the negative area of interest). This suggests that men who drink take longer to analyze elements of the semantic field. In comparison with the methodological approach used by [5], where pairs of drawings with positive (faces, flowers) and neutral (transport, alcohol) emotional-semantic content were used as stimulus material, our study used images with opposite emotional-semantic modalities: positive and negative, which allowed us to expand our understanding of the structure of oculomotor behavior in individuals who consume alcohol.

The nature of the attentional shift in individuals consuming alcohol towards a negatively charged image is explained by three models of alcohol behavior proposed by [6], which suggest the interdependence of alcohol consumption and anxiety [6]. The first model views anxiety disorders as a consequence of alcohol use disorders. The second approach is based on the premise that alcohol use disorders are a consequence of anxiety disorders. This model therefore considers alcohol to be an adaptogen, neutralizing anxiety. The third approach suggests that anxiety disorders and alcohol use disorders develop in parallel and independently due to the influence of some external or internal disruptive factor. In principle, the results of this study may reflect the interdependence of alcoholism and anxiety, as represented in each of the three alcohol behavior models. Regardless of the nature of the phenomenon under study, a person prone to maladaptation is simultaneously endowed with anxiety and a need for adaptogens. Additionally, the identified association between alcohol consumption frequency and headache occurrence in subjects confirms the psychosomatic nature of a person's propensity to drink alcohol. An assessment of the predictive capabilities of eye tracking for assessing a person's propensity to alcohol abuse demonstrated the insufficient sensitivity of the decision rules for the diagnostic model. However, the obtained results suggest the potential for further research in this area by expanding the range of analyzed indicators of a person's propensity to drink alcohol using a representative sample of subjects.

Conclusion

The study demonstrated the potential of using eye tracking to potentially assess a person's susceptibility to developing alcohol addiction. The use of visual objects not associated with alcohol but reflecting a person's propensity to demand adaptogens as stimulus images is justified. It has been determined that using images with opposing emotional-semantic modalities expands our understanding of the structure of oculomotor responses in individuals who consume alcohol. It was found that the number of fixations before the first fixation on a positive area of interest and the time before the first fixation on a positive area of interest were statistically significantly ($p<0.01$) higher in men who consumed alcohol than in men who did not consume alcohol. This pilot study has certain limitations. One of these is the small sample size, which limits the validity of the results. Furthermore, the study was limited to young men, preventing generalization to other age and gender groups. The results of this study suggest the need for further comprehensive study and validation of the preliminary associations between the studied phenomena using a representative sample of subjects, using additional methods for objectively assessing an individual's propensity to consume alcohol.

Competing Interests

The authors declare that there are no obvious and complex issues related to the publication of the articles in this document.

References

1. World Health Organization: Total acohol consumption per capita.
2. Summanwar D, Ropert C, Barton J, Rachael Hiday, Dawn Bishop, et al. (2024) Agile implementation of alcohol screening in primary care. BMC primary care 25(1): 251.
3. Qureshi A, Monk RL, Pennington CR, Thomas D W Wilcockson, Derek Heim (2019) Alcohol-related attentional bias in a gaze contingency task: Comparing appetitive and non-appetitive cues. Addictive Behaviors 90: 312-317.
4. Ghiță A, Hernández-Serrano O, Moreno M, Miquel Monràs, Antoni Gual, et al. (2024) Exploring Attentional Bias toward Alcohol Content: Insights from Eye-Movement Activity. European addiction research 30(2): 65-79.
5. Bollen Z, Kauffmann L, Guyader N, Carole Peyrin, Pierre Maurage (2023) Does alcohol automatically capture drinkers' attention? Exploration through an eye-tracking saccadic choice task. Psychopharmacology 240(2): 271-282.
6. Kushner M, K Abrams, C Borchardt (2000) The relationship between anxiety disorders and alcohol use disorders A review of major perspectives and findings. Clinical Psychology Review 20(2): 149-171.

ISSN: 2574-1241

DOI: 10.26717/BJSTR.2026.66.010347

Yulia A Shatyr . Biomed J Sci & Tech Res

Submission Link: https://biomedres.us/submit-manuscript.php