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ASSESSMENT OF MODERATE BLOOD ALCOHOL CONTENT EFFECTS ON SELECTIVE ATTENTION OF YOUNG LEARNERS IN THE DISTRICT OF ABIDJAN (IVORY COAST)

Serge Pacome Kouadio Koffi[1], Emmanuel Diboh[2*], Luc Kakou Gbalou[1], Kouadio Pacome N'go[3] and Et Antoine Neme Tako[1]

[1]Neuroscience Laboratory, Biosciences Training and Research Unit (UFR), Félix Houphouët Boigny University, Ivory Coast.

[2]Jean Lorougnon Guede University, Training and Research Unit of Environment, Daloa, Ivory Coast.

[3]Peleforo Gon Coulibaly University, Training and Research Unit of Biological Sciences, Korhogo, Ivory Coast.

***Corresponding Author: Emmanuel Diboh**

Jean Lorougnon Guede University, Training and Research Unit of Environment, Daloa, Ivory Coast.

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ABSTRACT

Alcoholism represents a real public health problem causing deaths worldwide. In addition to this, other side effects on health include functional disorders of mental attention and memory. Regular consumption of alcohol, though moderated, increases the risk of atrial fibrillation. Also, individual variability and particular sensitivity of young people suggest that this mode of consumption could cause learning difficulties in this group of the population. The aim of this study was to evaluate the effect of moderate alcohol consumption on selective attention of young learners (in school). The study compared the attentional performance of young people consuming alcohol in moderate doses to approximate a Blood Alcohol content of 0.2 g/L, 0.5 g/L and 0.8 g/L, using the Stroop test. These experiments showed that these doses (less than or equal to 0.8 g/L) did not significantly affect the selective attention capacities of either occasional or regular alcohol users. However, with psychoactive substances, caution is required, as the brain tends to crave for pleasurable experiences. An example shared by many people who can travel long distances to always enjoy a square meal. Thus, one can easily switch from a moderate to a harmful consumption of alcohol.

KEYWORDS: Moderate Alcohol - Stroop Test - Young Men - Selective Attention.

INTRODUCTION

Alcohol is considered the third most important risk factor for mortality, after high blood pressure and tobacco. It accounts for 3.8 % of global mortality (WHO, 2011). According to the French National Institute of Health and Medical Research (2001), the effects of alcohol consumption are a real public health problem. Alcohol abuse or its harmful use is a well-known risk factor for disability and premature mortality (Chukwuonye et al., 2013). Alcohol use by adolescents and young adults varies considerably between countries and cultures, in different population groups within a country (Ahlström et al., 2005). In Côte d'Ivoire, the study of Diboh et al, (2013) indicates that 79.47 % of students have consumed alcohol at least once, while 20.04 % consume it regularly. They were often seen drinking alcohol near schools amidst general indifference (Diboh, 2014). In addition to deaths and health damage, alcohol consumption causes social problems (Beaglehole and Bonita, 2009; Ramsoomar and Morojele, 2012). The toxic effects of alcohol on the brain can be demonstrated through medical imaging: a decrease in grey matter was particularly observed in alcohol-dependent individuals. The earlier the alcohol consumption began, significant is the alteration of the grey matter (Chanraud et al., 2006; Inserm, 2006). In Côte d'Ivoire, the study of Diboh (2014) showed the presence of disturbances in selective attention and working memory in adolescents and young adults who were not alcohol-dependent, but regularly consumed koutoukou (a local brandy made from the sap of palm oil tree Elaeis guineensis Jacq.). Alcohol consumption at even low doses could negatively impact on some of their cognitive functions such as attention and learning ability, due to inter-individual variability of alcohol effects (Crabb et al., 2004), but also to the particular sensitivity of young people to the neuroanatomical vulnerability of alcohol (Monti et al., 2005; Ryan et al., 2019). Thus, we aim to investigate the effects of moderate alcohol consumption on the selective attention of this group of population.

PATIENTS, MATERIALS AND METHODOLOGY

Patients

This study was carried out at the University of Félix Houphouët Boigny in Abidjan (Ivory Coast). It is a cross-sectional study using a questionnaire and

neuropsychological tests administered from the period of January to February 2022. In this study, 56 patients were recruited using a non-random sampling method (convenience sampling). The mean age of the patients was 20.8±3.4, with a mean body weight of 62.1±6.3.

Inclusion and exclusion criteria

The inclusion criteria were: be a male, be physically and mentally healthy, had once consumed alcohol, could read and were at least 18 years old. However, people with alcohol hypersensitivity, metabolic or cognitive disorders and colour-blind patients were excluded.

Technical material

The technical equipment consisted of: pure ethanol (99.8%); distilled water; artificial flavouring to improve the palatability of the solution; a measuring cylinder; a weighing scale; a laptop computer; a drinking glass; a stopwatch, a beaker and a Stroop test.

METHODOLOGY

Preparation and alcohol consumption

The alcohol solution consumed by participants had an ethanol concentration of 40 %. It was prepared by diluting ethyl alcohol (99.8%) with distilled water using the following formula

$Ci \times Vi = Cf \times Vf$

Ci = initial alcohol concentration
Vi = initial alcohol volume
Cf = final alcohol concentration
Vf = final alcohol volume

On the day of the test, participants were sober for at least 24 hours and fasted for 8 hours to allow a rapid absorption of alcohol (haber et al., 1996; Song et al., 2021). The tests were performed in a room isolated from external influences. Following an interview, participants who drank (5 or more glass of drinks) at least once a week were considered regular drinkers and those who drank (3-4 glass of drinks) less than once a month were classified as occasional drinkers (Cahalan and Cisin, 1968 and Diboh, 2014).

The participant's body weight was determined upon arrival in the experimental room. The volume of drink to be taken by participants was determined according to Widmark's formula (Widmark, 1932).

$T = (V \times P \times 0.8)/(K \times M)$

from which

$V = (T \times K \times M)/(P \times 0.8)$

T = being the approximate Blood Alcohol content
V = the volume of alcohol consumed by a participant in ml
M = body weight of individual in kg
K = the diffusion coefficient (K = 0.7 for men and k = 0.6 for women)
P = percentage of alcohol (40%)
0.8 = density of ethanol.

Participants were given five minutes to drink the experimental alcohol solution. The tests were carried out 15 minutes after drinking the beverage.

Alcohol administration to participants

Participants were organised into four study groups: a control group (T) and three experimental groups (E1, E2 and E3). Groups E1, E2 and E3 were asked to intake quantitiies of alcoholic solution in order to obtain approximate Blood alcohol content of 0.2 g/l, 0.5 g/l and 0.8 g/l respectively. The control group did not consume alcohol. Each group consisted of occasional drinkers (OD) (n=7) and regular drinkers (RD) (n=7).

Assessment of selective attention

Selective attention was assessed using the Stroop test according to the method used by Diboh (2014).
This test consists of three boards (see Appendix):
- plate 1 contains rectangles of different colours (green, red, yellow and blue) ;
- plate 2 consists of colour names written in black ink;
- and plate 3 contains names of colours written in coloured ink.

Each of the plates has 10 lines of 5 coloured words or rectangles. They were presented to participants in succession.
The test began with plate 1. On this plate there were rectangles of four different colours: green, red, yellow and blue. The participant was instructed to quickly name in a loud voice the colour of each rectangle, from left to right, moving to the next line at the end of each line. when they reach the end of the page, they start again within the expected time (45 seconds) frame.
Plate 2 had the names of four different colours written in black ink: green, red, yellow and blue. The participant was instructed to read these words as quickly as possible in an loud voice, moving from left to right, line by line, as in step 1.
Plate 3, puts the participant in an interference situation, contains names written in coloured ink (the colours green, red, yellow and blue). The instruction was not to read the word, but rather to name the colour in which each word is written as quickly as possible, line by line, from left to right.

Data collection

For each test, the number of words read or colours named during the 45-second time limit was recorded. Each time an error is detected (reading or naming error), the participant is immediately notified and asked to correct the error. The value taken into account is the score (number of words or named colours) for each test.

Variables

Variables in this study were of two types:
- the treatment variable (or classification) which are groups (T; E1; E2; E3) and the consumer categories (OD; RD)
- the dependent variables, which are the scores of the different tests.

Free consent: Informed consent was obtained from each participant beforehand.

Data processing

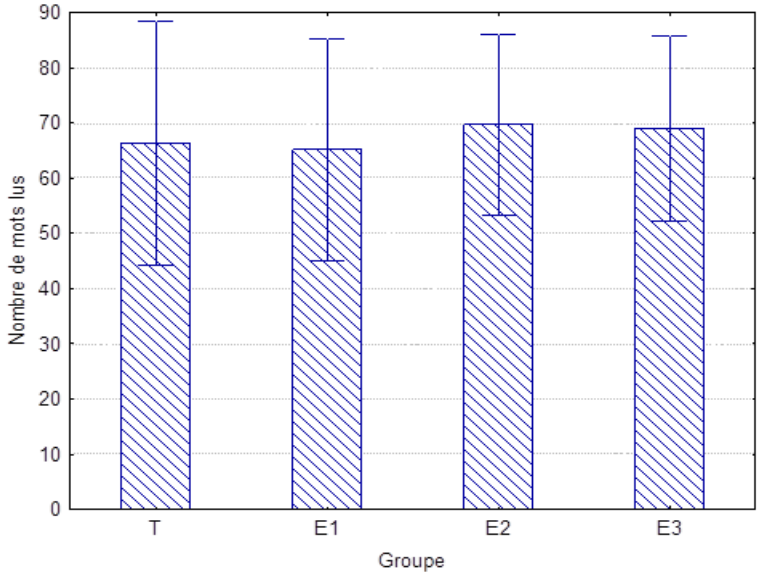
The collected data were first recorded on a spreadsheet (created by Microsoft Excel 2016), then transferred and processed using STATISTICA® 7.1 software. This software was used to generate graphs and to compare the mean performance of the different groups using the Kruskal-Wallis Test (non-parametric test). For the analysis of performance between categories (OD and RD), the Mann-Whitney U Test (non-parametric test) was used. The probability (p) at the threshold limit of 0.05 was considered as the value of significance.

RESULTS

Test 1

In the Stroop test, the performance (mean scores) of the four groups (T, E1 , E2 and E3) showed non-significant differences (H (3.56) =1.91, p=0.59) (Figure 1-a). Same results for the inter-group comparison for occasional drinkers (OD), for H (3; 30) = 2.35 and p = 0.50. For regular drinkers (RD), the difference in performance was not significant between the four groups (H (3; 26) = 0.81; p = 0.85) (Figure 1-b). For comparison within-groups (i.e. between occasional and regular drinkers) performance did not significantly differ for each of the 4 groups (T, E1, E2, E3), as the p-values were 0.85, 0.46, 0.80 and 0.45 respectively.

A



B

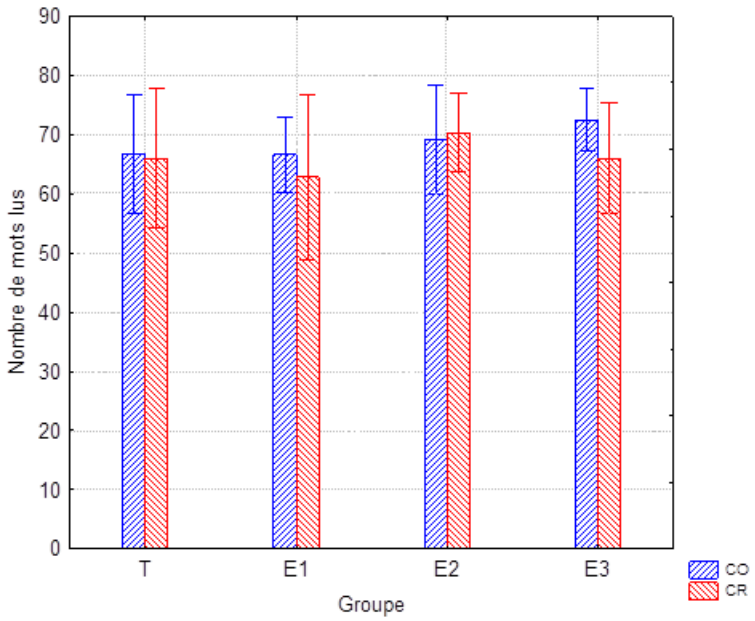
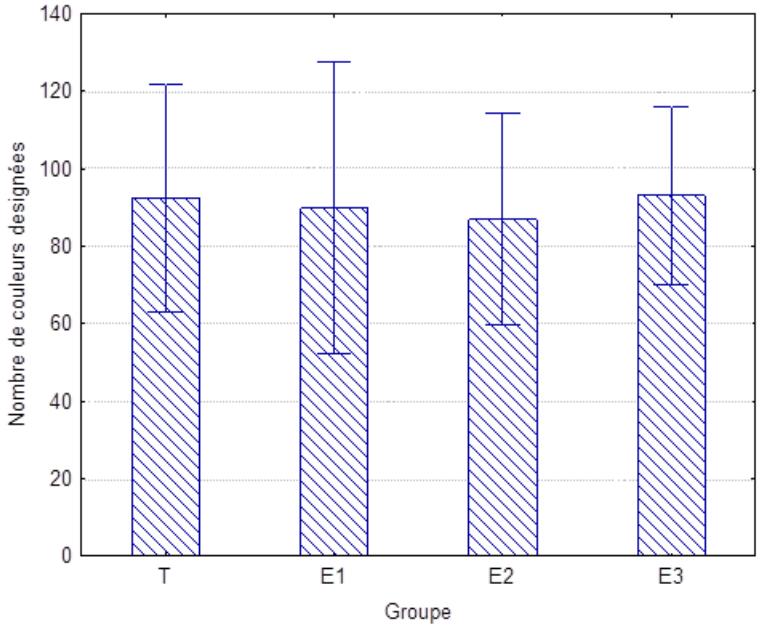


Figure 1: Mean scores for Stroop Test during trial 1 a) by group b) by group and category.

Test 2

Figure 2a presents the mean scores for Test 2 for groups T, E1 , E2 and E3. The differences observed were not significant (H (3.56) = 1.56; p = 0.67). Similarly, the analysis of data did not reveal any significant differences for either occasional drinkers (H (3;30) = 3.48; p = 0.32) or regular drinkers (H (3;26) = 1.29; p = 0.73) (Figure 2-b). Then, the comparison of performance of occasional drinkers with that of regular drinkers, by group, did not reveal any significant difference. Indeed, for the group T, the significance value p = 0.85 and was 0.53 ; 0.38 and 0.84 for groups E1, E2 and E3 respectively.

A



B

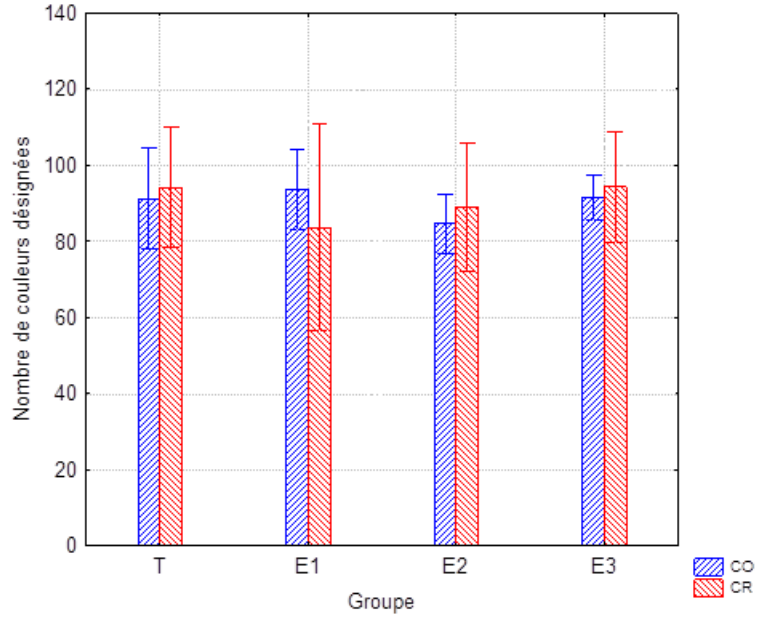
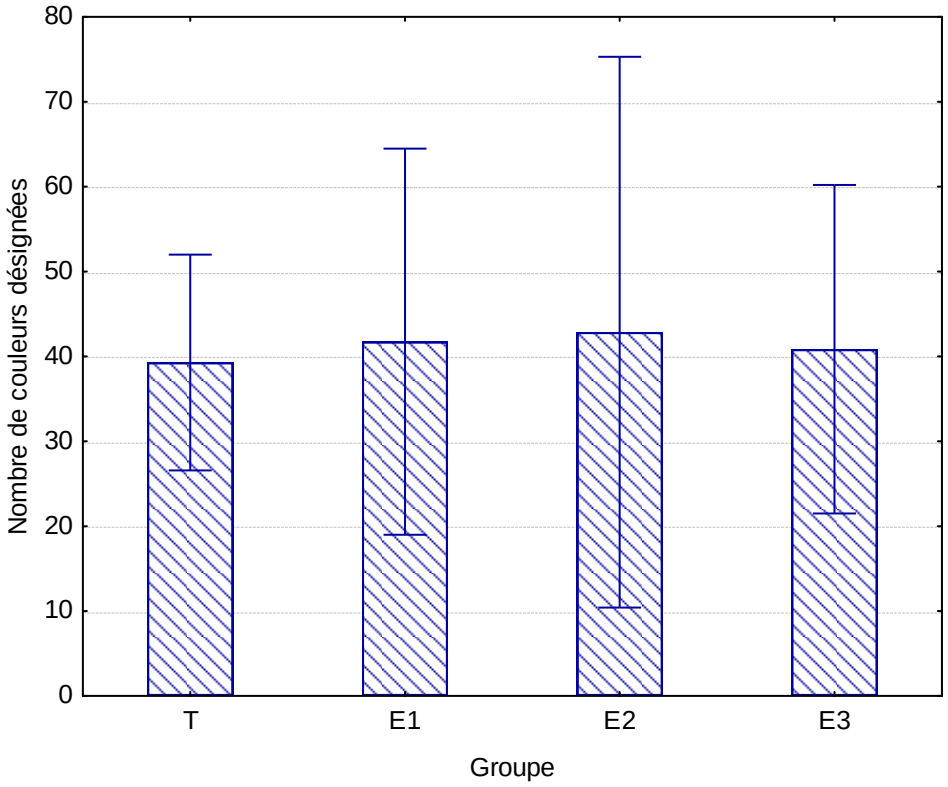


Figure 2: Mean scores for Stroop Test during trial 2 a) by group b) by group and category

Test 3

Figure 3-a shows the mean scores of the four groups for test 3 using the Stroop Test . Analysis of data revealed no significant differences between groups (H (3.56) = 0.49; p = 0.92). For occasional drinkers, the differences observed were not significant as the analysis indicated H (3;30) = 4.78 for p = 0.19. Similarly for regular drinkers, the differences observed were not significant (H (3.26) = 4.18; p = 0.24) (Figure 3-b). Thus, results of the mean scores analysis of occasional drinkers and regular drinkers for test 3 using the Stroop test by group did not show any significance differences. The p-value was equal to 0.11 for group T; 0.27 for group E1; 0.21 for group E2 and 0.10 for group E3.

a



b

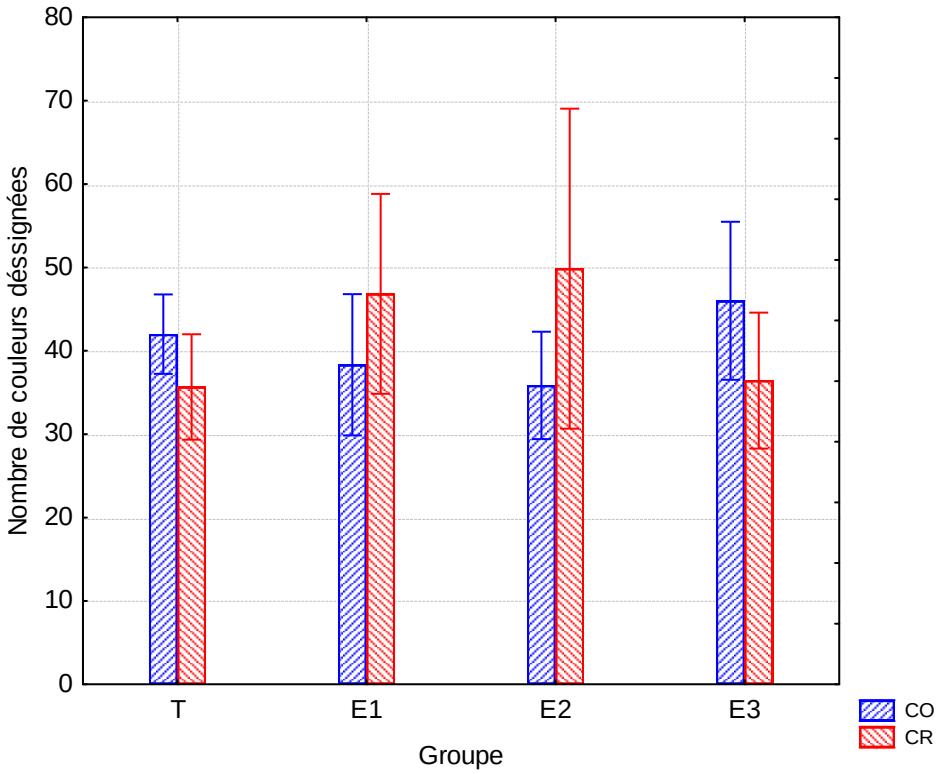


Figure 3: Mean Scores For Stroop Test During Trial 3 A) By Group B) By Group And Category.

APPENDIX : STROOP TEST

Plate 1

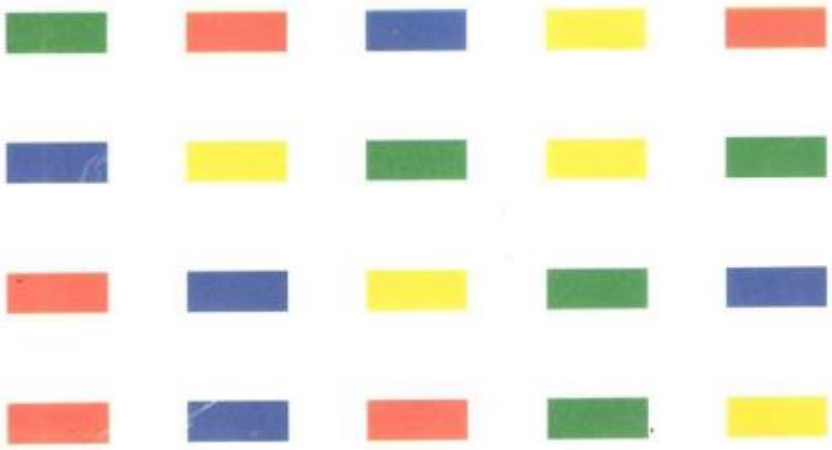


Plate 2

GREEN	BLUE	RED	GREEN	BLUE
YELLOW	YELLOW	BLUE	RED	GREEN
BLUE	YELLOW	GREEN	RED	BLUE
GREEN	RED	YELLOW	GREEN	YELLOW

Plate 3

BLUE	YELLOW	BLUE	RED	BLUE
GREEN	YELLOW	RED	GREEN	YELLOW
GREEN	RED	GREEN	YELLOW	YELLOW
YELLOW	RED	YELLOW	GREEN	BLUE

DISCUSSION

The aim of this study was to evaluate the effect of moderate blood alcohol contents (0.2 g/L, 0.5 g/L, and 0.8 grams of alcohol/litre of blood) on selective attention. For this purpose, young male drinkers were subjected to the Stroop test. The choice of male participants was done according to the recommendations of Ettorre (2004). Indeed, the fragility of women with regard to alcohol, according to the study of Perry (2004), showed that hormonal changes caused by the menstrual cycle did not allow set up effective conclusions in the case of inter-group comparisons.

Patients were divided into four groups, one (1) control group and three (3) experimental groups, depending on expected blood alcohol content. The results of this study

revealed that moderate alcohol intake (≤ 0.8 g alcohol/L of blood) did not have a statistically significant effect on participants' tasks.

The results reported in this study took into account all groups. Some participants showed significant impairment in selective attention with a blood alcohol content of 0.8 g/L and even 0.5 g/L. For this study, only male participants were taken into account.

Hormonal changes caused by the menstrual cycle did not allow to set up effective conclusions in the case of inter-group comparisons. Therefore, it was necessary to put participants in the same psychological conditions during the test. On the other hand, it is well known that women (girls) do not well tolerate alcohol than boys, due to their water deficit compared to men, knowing that Alcohol is miscible with water (Yao et al., 2011).

Jongen et al (2017) admitted that for a blood alcohol content of 0.50 g/L, the probability of having an accident doubled. However, for a mean-sized person weighing 70 kg, the blood alcohol content corresponds to the consumption of about three glasses of alcoholic beverage on an empty stomach, an amount that usually does not cause any obvious behavioural abnormalities. It has been shown that at such a dose of alcohol, a number of disturbances capable of impairing the performance of cognitive tasks were observed. Particularly, reaction time was prolonged and the visual field narrowed, especially when tracking targets (Beery, 2021). However, it is currently believed that accident risks associated with alcohol consumption are mainly due to its disinhibiting effect, leading in changes in risk-taking behaviour (Wickens et al., 2016).

Koelega (1995) was able to demonstrate cognitive changes for Blood Alcohol Content below 0.50 g/L, including a decrease of attention when measured with spatial stimuli. This also indicates that a Blood Alcohol Content of 0.2 g/L (caused by the consumption of a standard glass of alcohol drink) would be sufficient to disrupt the selective attention and divided attention abilities of young drivers. These differences can be explained primarily by the assessment methods used, but also by the environment and experimental conditions. These results were collected in the context of driving. In addition, one group of participants consisted of drivers with very little experience. For some authors (Horswill et al., 2020), driving requires cognitive skills, such as the ability to select relevant information, which for young drivers is particularly difficult, as they use more attentional resources than experienced drivers to perform simple tasks such as changing gears (Bladfält et al., 2020). Complex tasks, such as driving, require more attentional resources than simple or low-complexity tasks (Schweizer et al., 2005).

Diboh (2014) compared the attentional performance of different koutoukou consumers (occasional and regular consumers). Koutoukou is a local alcoholic beverage, with a high alcohol content, produced by distilling the fermented sap of oil palm (Elaeis guinéensis Jacq.). His work showed that the attentional performance of regular koutoukou consumers (with a blood alcohol content of 0.8 g/L) was significantly lower than that of the other groups in an interference situation (test 3). These results can be explained by the type of alcoholic beverage studied. In fact, apart from ethanol this brandy contains other alcohols such as methanol, butanol and propanol, which may extend its metabolisation time and caused more pronounced effects (Anonymous 2009 a and 2009 b). According to Yao et al (2011), the consumption of this hand made alcohol causes attention and some mental functions disturbances than the industrial alcohol.

According to Van Horn et al. (2006), the disturbances caused by alcohol consumption (whether low, moderate or excessive) on attentional performance can be explained by the action of alcohol on some cerebral areas and on the fronto-parietal networks which could be responsible for visuomotor and attentional functions.

Furthermore, an improvement in attentional performance has been observed in regular drinkers. Indeed, some authors attribute beneficial actions to moderate drinking (Mukamal et al., 2008; Fernadez-Sola, 2015; Lundgaard et al., 2018). It is also important to notice the variability of effects from person to person, influenced by drinking habits (Aseltine et al., 2000). The effects of alcohol may have a benefit, as it leads to a reduction of stress or inhibitions and creates a feeling of calm or stimulation. Wanner et al (2006) state that these effects depend on the current state of mind. For the person who was sad, angry or stressed before drinking, having a little alcohol may help him feeling better. However, this effect may be reversed and the person may quickly become even more sad or angry (Ballway et al., 2021).

CONCLUSION

In this study, the effect of moderate alcohol intake (one to three glasses of alcohol) on the selective attention of adolescents and young adults was assessed using the Stroop test. For this purpose, disturbances in selective attention were recorded for Blood Alcohol Content for less than or equal to 0.8 g/L. But they were not statistically significant. On the other hand, caution must be required for psychoactive substances. As the brain tends to crave for pleasurable experiences. An example shared by many people who can travel long distances to always enjoy a square meal. Thus, one can easily switch from moderate to harmful consumption.

Conflict of interest: "The authors declare no competing interests.

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