Original article

Current alcohol dependence and emotional facial expression recognition: a cross-sectional study

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Abstract

Background: Several studies have demonstrated that chronic and excessive alcohol use causes social cognition deficits. **Objectives**: Thus, the aim of the current study is to assess the associations between emotional facial expression recognition and current alcohol dependence. **Methods**: The sample consisted of two groups: one was composed by current alcohol dependent individuals (AG = 110); and a control group, composed of healthy individuals (CG = 110) assessed by the Structured Clinical Interview DSM-IV. The instrument to assess the recognition of facial expressions of emotion was a dynamic task at computer. **Results**: The AG showed low accuracy in recognizing emotions as a whole and especially fear and disgust. In addition, the group needed greater emotional intensity to recognize joy, fear, disgust and surprise. It also showed increased reaction time for all emotions ($p < 0.01$). The logistic regression showed the response time for surprise (ODDS = 1.01) and the ability to recognize emotions such as fear (ODDS = 0.68) and disgust (ODDS = 0.70) was significantly associated with alcohol dependence. **Discussion**: These specific associations are of great value to a more refined understanding of alcoholism, and they concern relapse and treatment.

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Introduction

It is known that although alcohol consumption is part of the daily habits of many people and that it is linked to prestige and pleasure, alcoholic beverages play an ambiguous role since they lead to serious public health issues worldwide[1]. There is a high percentage of hospitalizations to treat several diseases directly associated with alcoholism (liver cirrhosis, cerebrovascular diseases, cancer, gastritis, esophageal varices, pancreatitis, diabetes mellitus and tuberculosis)[2]. The high percentage of comorbidities such as mood, anxiety and personality disorders is also noteworthy. Such comorbidities increase the losses at different levels and lead to worse prognosis[3].

In addition to the aforementioned damages, the literature indicates that the excessive use of alcohol may cause psychomotor, visuospatial deficits, and neurocognitive deficits. Consequently, it may affect social cognition[4-6], which refers to the ability of decoding emotion signs in the faces of others, mainly when it comes to six basic emotions: anger, disgust, fear, sadness, joy and surprise. Thus, it is a key process to the emotional adaptive functioning[6,7].

Many studies have investigated the hypothesis of the origin of losses that comes along with chronic alcohol dependence and that favors social cognition impairments. Several groups of researchers, among them Jernigan *et al*.[8], Pfefferbaum *et al*.[9], Chen *et al*.[10] state that these changes result from the alcohol neurotoxic effects on the central nervous system. They report losses of white and gray matter in the temporal and in the parietal cortices, mainly in the dorsolateral portion of the frontal and prefrontal cortices, which mediate the emotional processing. On the other hand, another group of researchers[11,12] believe that genetic history may play an important role in the origin of the deficits, since it leads individuals to a greater predisposition to alcohol dependence and to the development of abnormalities in areas of the brain involved in emotion recognition.

Overall, the studies point out interesting findings. The first one to be highlighted refers to the lack of studies in the literature about alcohol dependent individuals who make active use of alcohol, to our knowledge. Therefore, the samples in these studies consist of individuals in the detoxification phase, abstainers, social drinkers or individuals under acute alcohol effect. Moreover, there are many analyzed variables, for example, monitoring of the electrical activity of the brain during the performance of cognitive tasks through electroencephalogram. These studies found that alcohol-dependent individuals showed lower brain activation in areas mediating visual, auditory and visual-motor processes, as well as difficulty to process anger[13,14].

Other studies have focused on investigating facial expression recognition of emotion (FERE) during neuroimaging examinations through functional magnetic resonance techniques. They found that alcohol dependent individuals present low brain activity in the cingulate, orbitofrontal and insular cortices during the recognition of fear[15] and disgust[16]; these areas are emotional processing mediators.

Meanwhile, some studies have focused the performance in tasks involving the FERE by alcoholics (detoxification or withdrawal phase) through the analysis of three outcome variables: accuracy, intensity of emotion and reaction time. According Donadon and Osório[17] the main findings of this review didn't evidenced any marked tendency. Also, an important limitation that deserves to be observed in this field of study was the lack of standard methodology, because the stimuli and procedures show a great diversity, which may influence considerably the results. In contrast, two recent meta-analysis involving subjects with alcohol use disorder (abstinent and/or alcohol detoxification phase) indicate that people with alcohol use disorders show worse FERE than controls, with an effect size of -0.67 IC (-0.95 to -0.39)[18] and also that alcoholics in detoxification, appears to be associated with significant impairment, at the recognition of disgust ($d = 0.62$) and anger ($d = 0.47$)[19].

Considering: a) the widespread damage observed in social cognition in alcoholics and the negative consequences that those may cause to the individual and b) losses in relationships/interpersonal interactions[7] and social coping skills, as the use of alcohol can be a maladaptive way to deal with the lack of behavioral repertoire before stressful situations day-to-day[20,21]. So the aim of the current study is to assess the associations between FERE and current alcohol dependence in a sample composed of male subjects.

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Methods

Individuals

The sample of the current study was selected by convenience and it was calculated the sample size, with an error rate estimated in 5% and the power of the test in 80%, as showed above in two different groups:

a) The current alcohol dependent individuals (AG) was composed by 110 male individuals over 18 years old, who were recruited in a clinic (outpatients) for alcoholic liver disease treatment of a university general hospital. All the individuals were diagnosed with current alcohol dependence by means of the Structured Clinical Interview (SCID-I, for DMS-IV) and across the criterion listed in the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV). The patients did not show hepatic encephalopathy.
b) The control group (CG), composed by 110 male subjects over 18 years old, who were recruited among the general population, mainly in primary health care services and in a non-governmental organization. These individuals had no history of alcohol abuse and/or dependence, according to the SCID-I.

It was decided to use a sample exclusively composed of males, since FERE may suffer influence of gender[22]. The CG and AG sociodemographic variables were paired in the current study, namely: age and education.

The exclusion criterion was the incorrect filling of the instruments or the absence of current alcohol dependence for AG group. Figure 1 shows the flowchart with the sample composition trajectory.

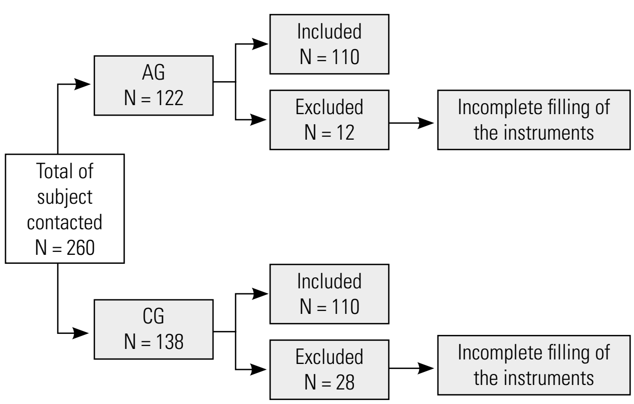

Figure 1. Flowchart of inclusion and exclusion of participants.

Instruments

The following instruments were used to characterize the sample:

Structured Clinical Interview for the DSM-IV (SCID-I – Clinical version) – It was suggested by Frist *et al.*[23] and then translated and adapted to Portuguese by Del-Ben *et al.*[24]. This instrument is used to perform psychiatric clinical diagnoses based on the DSM-IV. It consists of ten modules, which may be applied independently or in combination with other instruments, depending on the desired goals. The current study used Module E in order to diagnose alcohol dependence.

Beck Anxiety Inventory (BAI) – Self-applied instrument composed of 21 items, which assesses the presence and intensity of anxiety symptoms. The current study used the version translated to Brazilian Portuguese and adapted by Cunha[25]. The cutoff point considered to be the pathological anxiety indicator was twenty (20).

Patient Health Questionnaire – 9 (PHQ-9) – This instrument consists of nine self-administered items that assess the presence of depressive symptoms. The current study used the version validated to Brazilian Portuguese by De Lima Osório *et al.*[26]. The cutoff point considered to be the clinical depression indicator was ten (10).

Fagerstrom Test for Nicotine Dependence (FTND) – Self-administered instrument composed of six items to measure the degree of physical nicotine dependence. The current study used the version translated to Brazilian Portuguese and validated by Carmo and Pueyo[27]. The current study used this instrument in order to assess Tobacco dependence indicators.

Clinical and sociodemographic questionnaire – This instrument consists of 18 items and it was developed for the current study, it has the aim to collect complementary data about sociodemographic and clinical features. The current study used this instrument in order to characterize the sample.

Facial Expression Recognition of Emotion Task (FERET) – Computerized task consisting of a series of 24 stimuli composed of photographs of four actors from Ekman and Friesen[28] (two male and two female caucasians, in black and white), who represented features typical of the six basic emotions (happiness, sadness, fear, disgust, anger and surprise). It was created films of images that moved from a neutral 0% of emotion to 100% emotion, dynamically. There was an initial screen with instructions, which was followed by one film of image as an example, which by touching the computer screen, made appear a new screen where there were six options of answers (happy, sadness, fear, disgust, anger, surprise). After the example, the test started and the responses were saved automatically. These procedure was standardized by Arrais *et al.*[29]. The current study used this instrument in order to assess the outcome of variable accuracy and reaction time or intensity of emotion displayed.

Data collection and analysis

The present study was conducted in compliance with the ethical parameters in human research and approved by the Local Ethics Committee (HCRP Process n. 2316/2011).

Data were individually collected and inserted in a database. Subsequently, they were analyzed through: a) descriptive statistics: analysis of the sociodemographic and clinical features of the sample; b) parametric analysis: Student's *t* test (comparison groups); multivariate logistic regression – backward method (the outcome variables were accuracy, intensity of emotion and reaction time), whose p value was less than 0.20 were included in the initial logistic regression model[30].

It was adopted a significance level of $p < 0.05$.

Results

Table 1 shows the main sociodemographic and clinical features of the sample.

As it can be seen in Table 1 that most of the participants were married, with mean age 53 years, and they predominantly had elementary and high school education. No significant differences were found between these variables in the two groups. However, the groups statistically differ from each other in professional status. Most CG members were professionally active, whereas only less than half of the AG members had such professional status, thus it shows job loss in this group.

The AG showed indicators of depression, anxiety symptoms and tobacco dependence symptoms higher than those means of CG, although these average values are not as clinically significant, there was no significant correlations of these FERE variables with psychiatric comorbidities ($p < 0.05$).

Table 2 presents the accuracy indicator features, as well as the comparison between groups.

The AG group presented the smallest number of accuracy for emotions such as fear and disgust, as well as for the total of emotions with statistically significant differences between groups.

Table 1. Sociodemographic and clinical features of the sample according to alcoholics (AG) and control (CG) groups

Variables		AG		CG		Statistics
		N	(%)	N	(%)	
Gender	Male	110	100	110	100	–
Age	*X* *SD*	53.78 (8.24)		53.05 (8.82)		$t = -0.47$; $p = 0.52$
Marital status	Single Married Widower/divorced	22 64 24	20.0 58.2 21.8	16 79 15	14.6 71.8 13.6	$X^2 = 4.60$; $p = 0.10$
Children	Yes No	92 18	83.6 16.4	87 24	78.2 21.8	$X^2 = 12.32$; $p = 0.26$
Education	ES HS HE	62 36 12	56.4 32.7 10.9	60 38 12	54,6 34,5 10,9	$X^2 = 0.09$; $p = 0.96$
Professional status	Active Inactive	48 62	43.6 56.4	91 19	82.7 17.3	$X^2 = 36.13$; $p < 0.001$*
PHQ-9/Depression	*X* *SD*	6.69 (6.00)		2.65 (3.54)		$t = -6.069$; $p < 0.001$*
BAI/Anxiety	*X* *SD*	9.43 (9.50)		4.85 (6.56)		$t = -4.151$; $p < 0.001$*
FTND/Tobacco	*X* *SD*	2.21 (3.36)		1.05 (2.38)		$t = -2.935$; $p = 0.004$*
Alcohol doses consumed/day	*X* *SD*	7.64 (4.56)		0.10 (0.12)		$t = -17.32$; $p < 0.001$*
Alcohol abuse/years	*X* *SD*	29.36 (11.27)		– –		–

N: frequency; (%): percentage; *p*: significance level; X: mean; SD: standard deviation; *t*: Student's *t* test; X^2: Chi-square test; ES: elementary school; HS: high school; HE: higher education; *: statistically significant; AG: alcoholics group composed of individuals diagnosed with alcohol dependence; CG: control group composed of individuals with no diagnosis of alcohol dependence.

Table 2. Groups' mean, standard deviation and percentage of right answers in the emotional facial expressions recognition task

Emotions		AG (N = 110)	CG (N = 110)	Statistics
Happy	Mean (SD) Success rate	3.40 (0.97) 85%	3.62 (0.89) 90%	$t = 1.72$; $p = 0.09$
Sadness	Mean (SD) Success rate	2.01 (1.18) 50%	2.30 (1.31) 57%	$t = 1.72$; $p = 0.09$
Fear	Mean (SD) Success rate	1.33 (1.09) 33%	1.79 (1.07) 44%	$t = 3.17$; $p < 0.01$* d = 0.43
Disgust	Mean (SD) Success rate	1.89 (1.37) 47%	2.32 (1.17) 58%	$t = 2.48$; $p < 0.01$* d = 0.35
Anger	Mean (SD) Success rate	2.05 (1.26) 51%	2.16 (1.11) 54%	$t = 0.68$; $p = 0.49$
Surprise	Mean (SD) Success rate	2.25 (1.42) 56%	2.56 (1.35) 64%	$t = 1.70$; $p = 0.09$
Total	Mean (SD) Success rate	12.93 (4.85) 53%	14.75 (4.24) 61%	$t = 2.97$; $p < 0.003$* d = 0.40

SD: standard deviation; AG: alcoholics group composed of individuals diagnosed with alcohol dependence; CG: control group composed of individuals with no diagnosis of alcohol abuse and/or dependence; *p*: significance level; *t*: Student's *t* test; d: Cohen's; *: statistically significant difference.

Table 3 presents data about the reaction time required to respond in the FERE.

Table 3 shows statistically significance differences between AG and CG individuals in the reaction time during FERET for all the emotions. The differences indicate that AG members needed more time to process all the stimuli.

Table 4 presents the results of the emotional intensity required for FERE.

Table 4 shows that AG members required higher emotional levels to process the emotions of fear and disgust through facial expression. It also shows that there was statistically significant difference between the groups, except for emotions such as sadness and anger.

Is was also carried out analyses of the responses bias (percentage of wrong answer to each emotion). In relation to responses bias we did not found a specific bias to the emotions separately. However, when analysing the total number of responses to emotion, it was clear that the AG has issued more responses of happiness (19.31%, p = 0.003) and anger (19.16%, p = 0.05) when compared to CG, while the CG showed higher responses of fear (17.95%, p = 0.02) and surprise (22.31%; p = 0.02) when compared AG.

A multivariate logistic regression analysis was conducted to assess the associations between the FERE and the current alcohol dependence variables. The initial logistic regression model was not satisfactory and new models were tested by the backward method until reach the final model shown in Table 5.

Results show that the ability to recognize disgust and fear has an influence on current alcohol dependence and also a significant association with the condition of current alcohol dependence.

Table 3. Mean and standard deviation of the different groups according to the reaction time

Emotions		AG (N = 110)	CG (N = 110)	Statistics
Happy	Mean (SD)	11.25 (36.33)	8.66 (28.17)	$t = -5.91$; $p < 0.01$* d = 0.07
Sadness	Mean (SD)	13.61 (44.49)	11.50 (40.46)	$t = -5.91$; $p < 0.01$* d = 0.04
Fear	Mean (SD)	13.28 (45.00)	11.22 (36.88)	$t = -3.70$; $p < 0.01$* d = 0.05
Disgust	Mean (SD)	13.38 (40.67)	11.21 (35.73)	$t = -4.19$; $p < 0.01$* d = 0.05
Anger	Mean (SD)	14.26 (52.80)	11.92 (38.74)	$t = -3.74$; $p < 0.01$* d = 0.05
Surprise	Mean (SD)	12.90 (41.29)	10.69 (36.92)	$t = -4.18$; $p < 0.01$* d = 0.05
Total	Mean (SD)	13.07 (35.96)	10.81 (29.92)	$t = -5.05$; $p < 0.01$* d = 0.32

SD: standard deviation; AG: alcoholics group composed of individuals diagnosed with alcohol dependence; CG: control group composed of individuals with no diagnosis of alcohol abuse and/or dependence; *p*: significance level; *t*: Student's *t* test; d: Cohen's; *: statistically significant difference.

Table 4. Mean and standard deviation of the different groups in relation to the intensity of the emotion (percentage) required to recognize the emotion itself during the facial expression recognition task

Emotions		AG (N = 110)	CG (N = 110)	Statistics
Happy	Mean (SD)	91.86 (13.39)	80.20 (18.50)	$t = -5.35$; $p < 0.01$* d = 0.72
Sadness	Mean (SD)	96.10 (11.21)	93.42 (13.92)	$t = -1.57$; $p = 0.11$ d = 0.21
Fear	Mean (SD)	95.45 (12.89)	91.27 (14.23)	$t = -2.28$; $p = 0.02$* d = 0.30
Disgust	Mean (SD)	96.71 (8.98)	92.55 (17.80)	$t = -2.18$; $p = 0.03$* d = 0.33
Anger	Mean (SD)	96.66 (10.62)	94.16 (12.47)	$t = -1.60$; $p = 0.11$ d = 0.47
Surprise	Mean (SD)	94.66 (12.58)	89.40 (16.52)	$t = -2.65$; $p < 0.01$* d = 0.35
Total	Mean (SD)	97.12 (8.62)	91.76 (12.85)	$t = -3.63$; $p < 0.01$* d = 0.48

SD: standard deviation; AG: alcoholics group composed of individuals diagnosed with alcohol dependence; CG: control group composed of individuals with no diagnosis of alcohol abuse and/or dependence; *p*: significance level; *t*: Student's *t* test; d: Cohen's; *: statistically significant difference.

Table 5. Final logistic regression model to predict alcoholism

Variables	B	SE	P	OR	CI = 95%	
					Lower	Upper
Accuracy – Fear	-0.38	0.16	$p = 0.02$*	0.68	0.49	0.94
Accuracy – Disgust	-0.34	0.15	$p = 0.02$*	0.70	0.52	0.95
Reaction Time – Surprise	0.16	0.00	$p < 0.001$*	1.01	1.00	1.02

B: beta value; CI: confidence interval; OR: *odds ratio;* SE: standard deviation of the estimate; *p*: significance level; * Statistically significant difference.

Discussion

The aim of the current study was to evaluate possible associations between the FERE and current alcohol dependence, being observed overall damages at accuracy rate, reaction time, and intensity necessary for the recognition of emotions, with an effect size considered (d > 0.32).

The results from this study are unprecedented since, to our knowledge, this is the first to assess current alcohol use in dependent subjects. Prior studies at the literature conducted with abstinent and/or subjects at alcohol detoxification phase and they also pointed to global losses[31,32], in the same way that was observed in this study, signalling the convergence of results, regardless of the current or previous use of alcohol. In addition, a recent meta-analyses involving subjects with alcohol use disorder (abstinent and/or alcohol detoxification phase) also indicate more specific deficits, showing impairments at the recognition of disgust and anger[19].

The understanding of deficits in FERE in alcohol dependent individuals has two distinct possibilities: a) the deficits have been caused by etiological factors associated with alcohol use disorder and/or b) the possibility of the deficits had been caused by the consequences of excessive alcohol use. As the present study was not a longitudinal design, we will discuss the findings by taking both possibilities into account.

Several studies suggest that chronic alcohol use may *under-activate, over-activate* and even reduce the volume of the brain in some areas of the prefrontal and anterior cingulate cortices, of limbic structures, among others. Consequently, it would impair several cognitive functions such as the emotional information processing speed, the attention level during the task, memory, and the psychomotor skills, among others. These functions may lead alcoholic individuals to spend more time focusing on the task in order to respond to it, to need longer response times and to make more misjudgements mistakes[30,31,33-37]. In addiction, a recent meta-analyse[19] pointed out that toxic effects of alcohol on neuronal integrity could explain the deficits in emotion recognition, by changes at structural and connectivity in brain regions are consequence of excessive use of alcohol.

On the other hand, other studies also suggest that neurocognitive deficits may have a genetic origin and lead individuals to greater predisposition to alcoholism and to the development of abnormalities in areas of the brain used to process emotions[11,12,32,33]. This studies indicated that the predisposition may lead to the development of abnormalities in areas of the brain used to process emotions/cognitions, as well as may lead individuals to use alcohol[11,12]. Schandler *et al.*[32] found that pre-school children from families with alcohol-dependent individuals already present deficits in visuospatial information processing. In addition, D'Hondt *et al.*[33] reported that the changes found in FERE may be linked to changes in areas of the brain related to vision and/or to visual recognition prior to alcohol use. These changes are not directly linked to the excessive use of alcohol. It reinforces the necessity to find the intermodal aspect of express emotions (body posture or emotion auditory aspects) and not just through the use of visual stimuli.

Independent of the deficits origin, the literature points out several consequences such as losses at social and interactional contexts, losses at interpersonal relationships and interactions, since both the interpersonal relationships and the interactions are influenced by complex factors that involve, among others, non-verbal cues[7]. In addition, the presence of deficits in social coping skills, may be a maladaptive way to cope with the lack of behavioural repertoire against stressful daily situations[17,18].

The specific changes highlighted at current study, pointed to impairments at the recognition of fear and disgust. It is known that theses emotions are related to adaptive functions in the body. The adaptive value of fear is associated with the anticipation of danger, since fear triggers protective avoidance or escape behaviors in individuals facing imminent danger. Thus, by the correctly identifying of fear in people's faces, the individual becomes aware of the presence of nearby threats, and it helps them mobilizing resources to deal with danger[32,33].

The AG members showed low accuracy rate to recognize fear. They also needed longer response time and stronger emotional intensity to process the facial expressions. There were significant differences between the groups. This finding is corroborated by the previous literature, which also identified losses in individuals with prior use of alcohol during the FERE, mainly in the faces showing negative emotions such as fear[7,9,12,15,34-38]. It is mentioning by the literature that the recognition of fear, i.e., the ability to anticipate dangers (and to trigger protective behaviors), was associated with alcohol dependence[35,37].

According to the literature, the aforementioned changes were found in alcohol dependent individuals, because the excessive use of alcohol led to altered function of the prefrontal cortex, as well as of the limbic structures, with emphasis on the amygdale. Consequently, they harmed the processing and the accurate recognition of fear, since the limbic structures are involved in aggressiveness control, emotional memory, avoidance and escape responses, and in fear conditioning, among others[40,41].

These data are corroborated by Calder *et al.*[42] and Townshend and Duka[7], who pointed out that alcohol dependent individuals show less brain activation in the limbic region during the emotion (fear) processing task. In addition, O'Daly *et al.*[16] showed that alcohol dependent individuals were less able to recognize fear expressions than the control individuals, since they showed less activation in the prefrontal areas, including in the orbitofrontal cortex and in the insula, which also mediate emotional processing.

Another interpretation available in the literature points out that the lack of skill to recognize non-verbal signs of fear may be a path leading to alcohol dependence. Since alcohol dependent individuals do not accurately interpret signs of fear during social interactions, not even in possible conflicting (dangerous) social situations, favouring greater exposure and vulnerability, which may also be one of the factors triggering the beginning and/or the continuity of alcohol consumption[35-37].

Current alcohol dependent individuals also showed quite impaired recognition of disgust. This emotion, as well as fear, play a role at adaptive function, since it may refer to aversion or repulsion to things and/or objects that taste or smell bad, or that even have a rotten aspect. In addition, aversion or repulsion may appear in interpersonal relationships, as in the case of morally objectionable behaviours or inappropriate scenes. Therefore, their basic function is to keep individuals away from repulsive things[38].

The AG and CG members showed statistically significant differences between them. The AG members were less successful in recognizing disgust, and required more time and emotional intensity to process the facial expressions. This finding also corroborated by the previous literature, which identified losses in individuals with alcohol dependence (abstinent and/or detoxification alcoholics) during the emotional facial recognition task in expressions related to disgust[33-35,39-41] and also in agreement with a recent meta-analysis[19]. In addition, the study by Salloum *et al.*[15], which involved neuroimaging examination during FERE, found that alcohol dependent individuals had lower activation in the anterior cingulate cortex while processing disgust and sadness than the healthy controls. It indicated that the lower activation in this area of the brain may have been caused by the excessive use of alcohol, thus resulting in the less accurate recognition of such emotions.

It is worth highlighting that the accurate recognition of disgust also has negative association with alcohol dependence. Therefore, it is hypothesized that the accurate recognition of disgust works as protection against the disorder, because it makes individuals aware of threats and mobilizes them to avoid what is disgusting or even repulsive to them and/or to their culture[27,36,37].

The deficits found in the current study, in relation to surprise, were related to the need of longer reaction time and of greater emotional intensity in the recognition of surprise, and to the tendency of obtaining less correct answers in AG than in CG. Similarly, some authors have found that alcoholic individuals showed less accuracy in the recognition of surprise[38-40] they needed longer response time[32] and even greater emotional intensity[38,39] than the control group. However, other authors found no differences between groups in any of the aforementioned variables[7,15,40].

It is worth highlighting that the reaction time to process surprise was positively associated with alcohol dependence. Among the basic emotions, surprise lasts a few seconds and its valence may be either positive or negative. Thus, it is hypothesized that the quick recognition of surprise is a way to avoid something that is interpreted as threatening, dangerous or uncertain. Philippot *et al.*[40] pointed out that alcohol dependent individuals have difficulty to deal with positive emotions, since they anticipate these emotions as negative consequences (threat, danger, rejection), because the excessive use of alcohol has possibly caused greater activation in limbic structures such as the amygdala[7].

The current study did not find significant changes regarding sadness, anger or happy. These emotions were associated with longer reaction times in AG in relation to CG, and they showed statistically significant differences, as well as the trend of less accuracy rate for sadness and happy. In addition, biases of total responses were found for happiness in AG in comparison to CG. Such results corroborated some studies in the field showing little alterations at the bias responses[38,39,41]. On the other hand, and different from the present study, the meta-analyses[19] found that abstinent or detoxification alcoholics present deficits in the recognition of anger, which may be directly related to differences in sample characteristics or time of alcohol consumption.

Thus, the results of the present study overall suggest the worse performance of AG than that of CG, and it corroborates data found in the literature relative to the individuals who were not in current use of alcohol.

The fact that the individuals were not assessed for the presence or absence of possible cognitive and/or intellectual deficits may be seen as a limitation of the current study, since the literature indicates that alcohol dependent individuals may develop a range of cognitive impairments, such as dementia and/or encephalopathies, due to 0the use of alcohol[37-40]; fact that could directly and negatively affect FERE establishment and performance. This limitation is not specific to the current study, but it regards a gap in the literature, since only few studies have assessed the intellectual functioning[34,40,41]. Another limitation of the study involves the possibility of the presence of other psychiatric comorbidities, especially with personality disorders, which are not evaluated. The control of these confounding variables is important for future studies.

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