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Neuropsychological and psychophysiological profile of intimate partner violence perpetrators men: the role of alcohol

Perfil neuropsicológico y psicofisiológico de los hombres penados por violencia contra la mujer en las relaciones de pareja: el rol del alcohol

Dissertation

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Abbreviations

ANS = Autonomic Nervous System

AUD = Alcohol Use Disorder

CNS = Central Neurvous System

HA = High Alcohol consumption

IPV = Intimate Partner Violence

LA = Low Alcohol consumption

LTAA = Long-Term Abstinent Alcoholics

TSST = Trier Social Stress Test

Abreviaturas

AA = Alcohólicos Abstinentes

ACA = Alto Consumo de Alcohol

BCA = Bajo Consumo de Alcohol

SNA = Sistema Nervioso Autónomo

SNC = Sistema Nervioso Central

TCA = Trastorno por Consumo de Alcohol

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Abstract

Intimate Partner Violence (IPV) represents a serious public health problem worldwide. In recent years, growing evidence has established a significant relationship between IPV perpetration and heavy alcohol use. However, the scientific literature has not analyzed the effects of this alcohol consumption on neuropsychological and psychophysiological variables in IPV perpetrators. Alcohol might predispose perpetrators to cognitive alterations that affect emotional and behavioral regulation, and then predispose them to carrying out violent behavior in stressful or tense situations that are difficult for them to manage. Although attempts have been made to classify IPV perpetrators based on Autonomic Nervous System (ANS) reactivity to acute stress, subsequent studies have failed to replicate this classification. Notably, the classifications proposed have neglected the role of chronic alcohol abuse in ANS dysregulation and the fact that this dysregulation involves an abnormal stress response. Hence, this thesis aims to establish the neuropsychological profiles of IPV perpetrators and characterize the psychophysiological response to a laboratory task, analyzing the influence of different patterns of alcohol consumption. The sample was composed of a group of men sentenced to less than two years in prison for IPV from the Contexto Program with different levels of alcohol consumption (two groups), another group of men without IPV but with a history of alcohol use disorder (AUD), and a last group of control men without a history of IPV or AUD. A complete neuropsychological assessment was carried out, and the psychophysiological response was registered for the entire sample. Our results indicated that IPV perpetrators, specifically those with a high-risk level of alcohol use, showed greater cognitive deficits, mainly in executive functions, attention switching, memory, and empathic skills from perpetrators with a low-risk of alcohol use and non-violent men, and a higher parasympathetic predominance than perpetrators with a low risk of alcohol use. Moreover, non-violent men with AUD history also showed deficits in some executive, attentional and mnesic cognitive functions, but without empathic skill alterations and with a higher sympathetic predominance than controls. These findings offer broader knowledge about alcohol's effects on the neuropsychological variables of IPV perpetrators, in addition to

characterizing their psychophysiological functioning in response to a laboratory task. Thus, this information could be useful in the development of coadjutant intervention programs more adapted to their characteristics, thus reducing the future risk of IPV recidivism.

Resumen

La violencia contra la mujer en las relaciones de pareja hombre-mujer, representa un grave problema de salud pública a nivel mundial. En los últimos años, una mayor evidencia científica sustenta la relación entre la violencia contra la mujer y el consumo de alcohol. Sin embargo, existe un vacío en la literatura sobre los efectos que ejerce el consumo de alcohol sobre las variables neuropsicológicas y psicofisiológicas en los hombres que han cometido violencia contra la mujer. El consumo de alcohol podría predisponer a los agresores a presentar alteraciones cognitivas que afecten a su regulación emocional y comportamental y, por tanto, predisponer a conductas violentas en situaciones estresantes o de conflicto. Igualmente, se han llevado a cabo estudios que han clasificado a los agresores basándose en la respuesta del Sistema Nervioso Autónomo (SNA) al estrés agudo, no obstante, estudios posteriores no lograron replicar los resultados. Así pues, en la clasificación propuesta no se había considerado el efecto del consumo crónico de alcohol en la desregulación del SNA y su consecuente alteración de la respuesta al estrés. Por lo tanto, la presente tesis doctoral tiene como objetivo principal establecer los perfiles neuropsicológicos de los agresores, así como caracterizar su respuesta psicofisiológica a una tarea de laboratorio, analizando la influencia del consumo de alcohol. La muestra está formada por un grupo de hombres penados por violencia contra la mujer en las relaciones de pareja, con una pena de prisión menor a dos años de cárcel, provenientes del Programa Contexto, con diferentes niveles de consumo de alcohol (dos grupos); otro grupo de hombres sin antecedentes de violencia, pero con historial de trastorno por consumo de alcohol (TCA); y un último grupo control formado por hombres sin historial de violencia ni TCA. Se realizó una evaluación neuropsicológica completa y se registró la respuesta psicofisiológica en toda la muestra. Los resultados obtenidos indicaron que los agresores, sobre todo aquellos con un alto consumo de alcohol, mostraron mayores déficits cognitivos, principalmente en funciones ejecutivas, atención alternante, memoria y habilidades empáticas que los agresores con bajo consumo de alcohol y controles, y una mayor predominanacia parasimpática que los agresores con bajo consumo de alcohol. Además, los hombres con antecedentes de TCA, pero no violentos, también mostraron

déficits en varias funciones cognitivas ejecutivas, atencionales y mnésicas, pero sin alteración de las habilidades empáticas y con una mayor predominancia simpática en comparación con los controles. Estos hallazgos ofrecen un conocimiento más amplio de los efectos del alcohol en las funciones cognitivas de los agresores, así como de su actividad psicofisiológica en respuesta a una tarea de laboratorio. Así pues, la información obtenida podría ser aplicada en el desarrollo de programas coadyuvantes de intervención, más adaptados a sus características y, por tanto, en la reducción del riesgo de la reincidencia de la violencia contra la mujer en las relaciones de pareja.

Chapter 1

INTRODUCTION

Intimate partner violence (IPV) is a serious public health problem worldwide. It has been estimated that about one in three (35%) women in the world have suffered physical and/or sexual dating violence, or sexual violence from others at some point in their lives. Moreover, it has also been estimated that 38% of murders of women are committed by their own partners (World Health Organization, WHO, 2016). Due to the physical, psychological, sexual, and reproductive health consequences of these forms of violence in victims (Martínez, Sánchez-Lorente, & Blasco-Ros, 2010; Vil, Carter, & Johnson, 2018) and the high economic impact and social costs in Western societies (WHO, 2016), it is necessary to carry out studies to identify the main risk factors in perpetrating this kind of violence. This will allow to develop more effective prevention and intervention programs adapted to perpetrators' characteristics and thus, reduce the incidence and recidivism of violence against women (WHO, 2016).

In recent years, significant advances have been made in the scientific research on the psychological predisposing factors to IPV in aggressors. However, the prevalence in our society continues to reach alarming levels, and many questions and research challenges still remain to achieve better understanding and prevention of the problem (Heise, 1998, 2011; Heise & Kotsadam, 2015; Jewkes, 2002; Jewkes, Flood, & Lang, 2015). An interesting way to understand how IPV perpetrators might be prone to this kind of violence is to study how they process information by assessing neuropsychological variables (Pinto et al., 2010; Romero-Martínez & Moya-Albiol, 2013). In this regard, a systematic review established that, compared to non-violent men, IPV perpetrators presented more executive dysfunction, memory, and attention impairments, as well as deficits in their empathic skills (Romero-Martínez & Moya-Albiol, 2013). These impairments can lead to an inability to resolve conflicts through conciliatory mechanisms, such as negotiation or cooperation, thus making the appearance of violence more likely (Farrell, 2011). Moreover, previous studies have suggested that the executive dysfunction observed in IPV perpetrators, specifically the lack of cognitive flexibility, could partially explain why they maintain sexist schemes and other rigid behaviors that interfere with the adaptation of their conduct to the changing situations of their environment and keep them from learning from their mistakes or punishments (Romero-

Martínez, Lila, Martínez, Pedrón-Rico, & Moya-Albiol, 2016a; Romero-Martínez, Lila, & Moya-Albiol, 2016b; Romero-Martínez, Lila, & Moya-Albiol, 2016c; Romero-Martínez & Moya-Albiol, 2013). The maintenance of such negative ideologies about their partner and the lack of empathy in perpetrators make them ignore the severity of their actions, which could facilitate the violent behavior (Cárdenas, et al., 2010; Gracia, García, & Lila, 2011; Gracia & Herrero, 2006; Gracia & Tomás, 2014; Thoma et al., 2011). However, previous studies have neglected the role of alcohol consumption in the aforementioned deficits. Thus, it is important to consider whether alcohol consumption tends to diminish behavioral regulation, with this association mediated by cognitive deficits.

It has previously been established that alcohol consumption increases IPV perpetration risk (Cafferky, Mendez, Anderson, & Stith, 2018; Eckhardt, Parrott, & Sprunger, 2015; Foran & O'Leary, 2008; Langenderfer, 2013), but little is known about variables that mediate this relationship. Thus, it would be necessary to develop studies that analyze the mediating variables in this relationship, such as cognitive deficits and psychophysiological correlates (Bayless & Harvey, 2017; Romero-Martínez, Lila, Sariñana-González, González-Bono, & Moya-Albiol, 2013a; Romero-Martínez et al., 2016a; Romero-Martínez & Moya-Albiol, 2013; Thomas, Bennett, & Stroops, 2012).

A high percentage of IPV perpetrators present heavy drinking and/or commit violent acts under the influence of alcohol (Catalá-Miñana et al., 2017; Crane, Godleski, Przybyla, Schlauch, & Testa, 2016; Easton & Crane, 2016; Klostermann & Fals-Stewart, 2006; Eckhardt, Parrott, & Sprunger, 2015; Lila, Gracia, Catalá-Miñana, Santirso, & Romero-Martínez, 2016; Lila, Gracia, & Catalá-Miñana, in press; López-Caneda et al., 2014; Romero-Martínez et al., 2016b; WHO, 2016). In this regard, it has been suggested that alcohol acts as a central nervous system (CNS) depressor, increasing limbic activation and inhibiting the functioning of the prefrontal cortex. Thus, this progression could underlie the alteration of cognitive processes required for correct behavioral regulation and social adjustment, such as logical reasoning and decision making (Heinz, Beck, Meyer-Lindenberg, Sterzer, & Heinz, 2011; López-Caneda et al., 2014; Pedrero-Pérez et al., 2009, 2011, 2013; Romero-Martínez et al., 2013a; Romero-Martínez, Lila, Catalá-Miñana, Williams, & Moya-Albiol, 2013b;

Romero-Martínez et al., 2016b). Nevertheless, not all IPV perpetrators tend to present heavy alcohol consumption, and so alcohol consumption cannot always be considered a direct cause of IPV perpetration. Hence, there is a need for additional research with alcoholic and abstinent men in order to study whether there is a specific profile that predisposes or protects from violent behaviors, and the relationship of this profile with other personal and psychosocial variables.

Alcohol consumption is associated with a wide range of physiological effects, including alterations in the Autonomic Nervous System (ANS) activity (Boschloo et al., 2011; Miralles, Espadaler, & Rubiés-Prat, 1995), but the alterations produced by heavy drinking, which facilitates aggressive behaviors, still need to be clarified (Chida et al., 1994; Chida, Takasu, & Kawamura, 1998; Crouch et al., 2015; Karpyak et al., 2014; Monforte et al., 1995; Mukherjee, 2013; Reed, Porges, & Newlin, 1999; Villalta, Estruch, Antúnez, Valls, & Urbano-Márquez, 1989). In fact, it has been suggested that chronic alcohol consumption tends to depress the CNS, suppressing excitatory nerve pathway activity (Mukherjee, 2013), but there are inconsistencies about whether alcohol tends to reduce sympathetic or parasympathetic control of the ANS in stressful situations, such as marital conflict (Karpyak et al., 2014; Mukherjee, 2013). In any case, alcohol alters cardiac variability, reducing its flexibility and ability to adapt to environmental changes (Karpyak et al., 2014), which could facilitate the appearance of violent and antisocial behaviors (Crouch et al., 2015). Thus, given the influence of ANS functioning on human behavior (Portnoy & Farrington, 2015; Portnoy et al., 2014; Wilson & Scarpa, 2011), the study of how alcohol could modify this system in IPV perpetrators should be considered.

Romero-Martínez et al. (2013a, 2014) studied a group of reactive IPV perpetrators and compared them with a group of non-violent men (controls) on the ANS-response to a modified version of the Trier Social Stress Test (TSST). In this study, IPV perpetrators showed greater hyperreactivity of the sympathetic nervous system compared controls, and this hyperreactivity was related with impulsivity traits. The sympathetic predominance observed in this population might be indicative of an ANS dysregulation. Thus, individuals with this psychophysiological profile maintain high levels of vigilance (or activation), irritability, and tension over sustained periods of time, reducing the threshold to violent behavior when exposed to certain types of stimuli that are incongruent with their hostile cognitive schemas, such as sexist ideas about women or dominant roles in relationships (Dawson, Schell, & Filion, 2000). However, as discussed above, there are still inconsistencies about the specific ANS-response to stress in IPV perpetrators (Karpyak et al., 2014; Mukherjee, 2013). These inconsistencies may be due the kind of stimulus used in each study and other variables, such as the consumption of alcohol, which has not been considered previously, the age the person started drinking, the duration of active drinking, or the time of alcohol abstinence in those who have chosen to abstain from alcohol consumption. This makes it necessary to conduct new studies that consider these types of markers in order to delve into the profiles that characterize them.

This doctoral thesis aims to establish the neuropsychological profile of IPV perpetrators and characterize the psychophysiological response to a laboratory task, analyzing the influence of alcohol consumption. Thus, the objectives and hypotheses suggested are summarized below:

1. *To examine the effect of alcohol on the cognitive processes of individuals with different levels of alcohol consumption who have committed IPV and non-violent individuals (control group).* We hypothesized that IPV perpetrators would manifest more extensive neurocognitive dysfunction, specifically more executive, attention, memory and empathic impairments, than non-violent individuals (Pinto et al., 2010; Romero-Martínez & Moya-Albiol, 2013; Romero-Martínez et al., 2016c). Moreover, we expected that IPV perpetrators with high alcohol consumption (HA IPV perpetrators) would have more extensive and severe cognitive impairments than perpetrators with low alcohol consumption (LA IPV perpetrators) and controls (Aresi et al., 2016; Beck, Heinz, & Heinz, 2014; Catalá-Miñana, Lila, & Oliver, 2013; Heinz et al., 2011; Lila, Gracia, & Català-Miñana, 2017).

2. *To assess the relationship between alcohol and cognitive flexibility among IPV perpetrators, and its relationship with other socio-cognitive variables that could*

be related to a higher predisposition to violence. We expected to find that IPV perpetrators with higher alcohol consumption would report lower levels of mental flexibility than those with lower alcohol consumption (Romero-Martínez et al., 2013a; 2013b; Romero-Martínez & Moya-Albiol, 2013; Romero-Martínez et al., 2016a; 2016b). Given the association between cognitive flexibility and some psychosocial variables related to IPV, we hypothesized that men with low levels of cognitive flexibility would present less cognitive empathy (Thoma et al., 2011), more hostile sexism (Cárdenas, Lay, González, Calderón, & Alegría, 2010; Teichner, Golden, Van Hasselt, Peterson, 2001), higher trait anger and levels of anger expression (Romero-Martínez et al., 2013b) and less perception of severity of their own violent behavior (Gracia et al., 2011; Lila, Gracia, & García, 2013), than men with high levels of cognitive flexibility.

3. *To study the cognitive effects of alcohol consumption in long-term abstinent alcoholics (LTAA) and non-alcoholic individuals (control group), in order to establish differential neuropsychological profiles.* Alcohol consumption has been associated with a higher predisposition to IPV. However, it cannot be considered the only cause of IPV perpetration. Therefore, an additional study was proposed in alcoholic men in order to find out whether there is a specific profile that protects or predisposes them to violent behaviors. Although we initially collected inpatients from an alcohol abuse clinic, the majority of those who participated in our study were in an abstinence period of more than twelve months (LTAA group). It was quite difficult to identify a group of alcoholic men who are still consuming alcohol and agree to voluntarily participate in research. Moreover, the IPV perpetrators who participated in our study actively consumed alcohol. For this reason, these groups were not directly comparable, and new comparisons were made between LTAA and controls. Hence, in light of previous findings regarding persistent cognitive impairments in patients with alcohol use disorders (AUD) after long-term periods of abstinence (Alhassoon et al., 2012; Nowakowska-Domagała, Jabłkowska-Górecka, Mokros, Koprowicz, & Pietras, 2017; Stavro,

Pelletier, Potvin, 2013), we hypothesized that LTAA would manifest neuropsychological dysfunctions compared to controls.

4. *To compare the effect of alcohol consumption on the ANS response to a laboratory task of a group of IPV perpetrators with current high-risk and low-risk alcohol use compared to a non-violent group (controls).* Because chronic heavy alcohol consumption has a depressive effect on ANS activity (Chida et al., 1994; 1998; Monforte et al., 1995; Mukherjee, 2013), we hypothesized that HA IPV perpetrators, due to the effects of alcohol, would show lower sympathetic predominance and higher vagal regulation in response to stress than LA IPV perpetrators and controls.

5. *To investigate whether the influence of alcohol on LTAA would produce a differential emotional and psychophysiological response to an acute laboratory standardized stressor compared to a non-alcoholic control group.* Giving the effects of alcohol consumption on the ANS, we proposed to study whether there is a specific psychophysiological profile of abstinent alcoholic men without a history of IPV. We expected that chronic LTAA would present a lower sympathetic reactivity of the ANS compared to controls (Chida et al., 1994, 1998; Monforte et al., 1995; Mukherjee, 2013).

Chapter 2

Study 1: Differential cognitive profiles of intimate partner violence perpetrators based on alcohol consumption

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Introduction

Intimate partner violence (IPV) represents a major public health challenge around the world. According to summary statistics compiled by the World Health Organization (WHO, 2016), about 35% of women in the world have suffered physical and/or sexual partner violence at some point in their life, and 38% of murders of women that occur in the world are committed by a male intimate partner. It has found a positive association between alcohol consumption, especially at hazardous levels, and IPV (Cafferky, Mendez, Anderson & Stith, in press; Foran & O'Leary, 2008; Langenderfer, 2013). Specifically, IPV perpetrators are five times more likely than non-perpetrators to consume alcohol (Luthra & Gidycz, 2006; WHO, 2016), and men with alcohol problems are generally more likely to commit violence against their intimate partners (Klostermann & Fals-Stewart, 2006; Catalá-Miñana, Lila, Oliver, Vivo, Galiana, & Gracia, 2017; Crane, Godleski, Przybyla, Schlauch, & Testa, 2016; Easton & Crane, 2016). Moreover, IPV perpetrators who are starting alcohol abuse treatment are known to be a high-risk group for violence and IPV recidivism (Duke, Giancola, Morris, Holt, & Gunn, 2011; Eckhardt, Parrott & Sprunger, 2015; Lila, Gracia, Catalá-Miñana, Santirso, & Romero-Martínez, 2016; Romero-Martínez, Lila, Pedrón, Martínez & Moya-Albiol, 2016; WHO, 2016; Lila, Gracia, & Catalá-Miñana, in press). Hence, alcohol consumption could be considered a major contributor to the occurrence of IPV.

Empirical literature regarding the neuropsychological status of IPV perpetrators is extremely limited. Specifically, despite extensive evidence of heterogeneity in IPV perpetrator profiles, there has been notably little research into neuropsychological deficits which might help us understand differences within this violent population. A systematic review established that compared to non-violent men, IPV perpetrators have executive dysfunction, low levels of cognitive flexibility, inhibition, processing speed, verbal and attention skills, abstract reasoning, cognitive empathy and emotion decoding skills, and working and long-term memory impairments (Romero-Martínez & Moya-Albiol, 2013). Moreover, executive dysfunctions have been associated with impulsivity and disinhibition, especially when individuals present a chronic hazardous alcohol use. In fact, alcohol consumption will lead to a decrease in behavioural control producing deficits in executive controls after sustained alcohol use, increasing the likelihood to adopt risky behaviours and to search for extreme sensations without consider the future consequences of their behaviour (Kravitz et al., 2015; Oscar-Berman & Marinković, 2007; Staples & Mandyam, 2016).

Further, previous studies have not paid much attention to the role of alcohol abuse in the cognition of IPV perpetrators. Indeed, only a few studies have analysed the role of alcohol abuse in IPV perpetrators' cognitive skills. Alcohol abuse could impair several cognitive domains which underlie IPV such as cognitive functioning, cognitive empathy and emotion decoding skills (Beck & Heinz, 2013; Heinz, Beck, Meyer-Lindenberg, Sterzer, & Heinz, 2011; Romero-Martínez, Lila, Catalá-Miñana, Williams, & Moya-Albiol, 2013; Romero-Martínez, Lila, Martínez, Pedrón-Rico, & Moya-Albiol, 2016; Romero-Martínez, Lila, Sariñana-González, González-Bono, & Moya-Albiol, 2013). Several models have been proposed to explain alcohol-related violence as a result of interference in cognitive and emotional skills. One hypothesis, known as the Alcohol Myopia Model (Steele & Josephs, 1990), states that drinking is associated with IPV because alcohol consumption produces a "myopic" effect, deteriorating the cognitive process of attention and facilitating violence by focusing attention onto more salient provocative signals in hostile situations, rather than less salient inhibitory ones (Bayless & Harvey, 2017; Giancola, Josephs, Dewall, & Gunn, 2009; Giancola, Josephs, Parrott & Duke, 2010; Giancola, Duke & Ritz, 2011). Knowledge of deficits in these cognitive and affective domains could be used to guide the development of early cognitive and affective training initiatives seeking to improve the affected domains and in turn reduce the rate of recidivism.

The current study was designed to examine neuropsychological differences between individuals with different levels of alcohol consumption who have committed domestic violence and non-violent individuals (control group), to establish differential neuropsychological profiles. In the light of previous findings regarding neuropsychological differences between IPV perpetrators and non-violent individuals, we hypothesized that IPV perpetrators would manifest more extensive neurocognitive dysfunction, specifically more impairments in attention, memory, executive function, cognitive flexibility, planning, decision-making, emotion decoding skills and perspective taking, than non-violent individuals (Romero-Martínez & Moya-Albiol, 2013). Moreover, evidence suggests that people with histories of heavy or problem drinking are either predisposed to violence or that such chronic use causes or exacerbates cognitive and emotional deficits associated with violence (Beck, Heinz, & Heinz, 2014; Beck & Heinz A, 2013; Heinz et al., 2011). Hence, we expected that IPV perpetrators with problem drinking would have more extensive and severe cognitive impairments than the other groups. The analysis of these variables and their relationships may improve our understanding of the role of alcohol abuse in the relationship between neuropsychological deficits and the facilitation and maintenance of IPV. Our findings may also make it possible to tailor treatment for IPV perpetrators and contribute to the development of programs to enhance neuropsychological functioning as an adjunct to psychoeducational and community psychological therapies.

Methods

Participants

The final sample was composed of 100 men who participated voluntarily in the study: 28 IPV perpetrators with high alcohol consumption, 35 IPV perpetrators with low alcohol consumption and 37 individuals with no history of violence, as the control group. Two IPV perpetrators were excluded from the study because they presented psychopathological signs. All participating IPV perpetrators were recruited from the community psychological and psychoeducational treatment program, *CONTEXTO*, at the Department of Social Psychology of the University of Valencia (Spain). This is a court-mandated program for men sentenced to less than 2 years in prison for violence against women in intimate relationships who had no previous criminal record, and therefore, received a suspended sentence on condition that they attend this type of intervention program (Lila, Gracia, & Herrero, 2012; Lila, Oliver, Catalá-Miñana, & Conchell, 2014; Lila, Oliver, Galiana, & Gracia, 2013b). Requirements for participating included: having being sentenced to prison for IPV; not having been convicted for assault outside the home; and not being diagnosed with any mental illness. All the IPV perpetrators who were candidate participants were interviewed by trained researchers (with extensive experience treating IPV perpetrators) to assess their mental health. Cohen's kappa, used to assess inter-rater agreement between qualitative interviewers in the nine psychopathological dimensions evaluated (the same dimensions as the Symptom Checklist 90-R, SCL-90-R, González de Rivera et al., 1989), ranged from .67 to .84. Regardless of the SCL-90-R scores, the interviewees were considered not to have any psychopathological signs and symptoms if they scored less than the mean for their age for each dimension. They were then considered eligible to participate if the qualitative interviews and SCL-90-R scores confirmed they were free of mental illness.

High alcohol consumption was operationally defined as alcohol intake higher than 30 g/day (Cao, Willett, Rimm, Stampfer, & Giovannucci, 2015; Cho, Lee, Rimm, Fuchs, & Giovannucci, 2012; Scoccianti et al., 2016). IPV perpetrators who reported >32 g/day of alcohol intake and presented four or more symptoms of Alcohol Use Disorder (AUD) listed in the DSM-5 were assigned to the high alcohol consumption (HA) group. Conversely, IPV perpetrators whose reported intakes lower than 25 g/day and presented less than two DSM-5 symptoms for AUD were included in the low alcohol consumption (LA) group. Those IPV perpetrators abstinent for one year were rejected.

Controls were recruited by mailings and advertisements. Inclusion criteria were that they had similar socio-demographic characteristics to the experimental groups, alcohol consumption lower than 30 g/day, and less than two DSM-5 symptoms of AUD, as well as a criminal record certificate demonstrating that they had no history of violence.

All participants were right-handed and healthy, lived in Valencia (Spain), were properly informed about the research protocol and gave written informed consent. The research was conducted taking into account current ethical and legal guidelines on the protection of personal data and research with human beings in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of the University of Valencia (H1348835571691).

Procedure

All participants attended three consecutive sessions at the Faculty of Psychology of the University of Valencia. In the first session, participants were interviewed to exclude those with organic diseases and socio-demographic data were collected through a semi-structured interview. Then, participants were asked about their consumption of alcohol and cigarettes, in terms of both the amount consumed and how long they had been abstinent. Subsequently, they completed an inventory based on DSM-5 to check for the presence of AUD, and the Fragerström Test of Nicotine Dependence to assess addiction level. Lastly, they were asked if they had a history of traumatic brain injury, noting whether they had lost consciousness during the trauma; for example, had they been involved in fights, and if so, how often this had resulted in head injuries and had they had blackouts after these injuries.

In the second session, a range of neuropsychological variables were assessed using traditional tests and also the computer-based Cambridge Neuropsychological Test Automated Battery (CANTAB). Executive functions, including cognitive flexibility, planning and decision making, were assessed with the Wisconsin Card Sorting Test (WCST), Zoo test, Key test, One Touch Stockings of Cambridge (OTS) and Cambridge Gambling Task (CGT); attention with the Attention Switching Task (AST) and Rapid Visual Information Processing (RVP); memory with the Word List, Logical Memory and Spatial Span subscales of the Wechsler Memory Scale (WMS-III), and cognitive ability with the Digit Span, and Letter-Number Sequencing subscales of the Wechsler Adult Intelligence Scale-III (WAIS-III), and the Rey–Osterrieth Complex Figure (ROCF) test. In addition, emotion decoding skills were assessed with Reading the Mind in the Eyes test (Eyes Test).

In the third session, psychological variables were assessed. Participants' levels of hostile and benevolent sexism were assessed with the Ambivalent Sexism Inventory (ASI); behaviours related to frontal dysfunction with the Frontal Systems Behaviour Scale; empathy, with the Interpersonal Reactivity Index (IRI); and finally, the type of relationship they had with their partners with the Conflict Tactics Scales 2 (CTS2).

The end of the assessment was marked by displaying a sign saying "Thank you very much" participants were paid €50 for their participation and told that they could leave.

Frontal Behaviour

The Spanish version of the *Frontal Systems Behaviour Scale (FrSBe)* (Caracuel et al., 2012) was used for this study. This psychometric instrument is used to evaluate non-cognitive changes in behaviour and provides a brief, reliable and valid measure of three frontally-based behavioural syndromes: apathy, disinhibition and executive dysfunction. The FrSBe is a 46-item scale that is easy and relatively quick to administer (taking around 10 minutes). It provides a total score measuring overall executive impairment, as well as three subscores associated with the three frontal syndromes: apathy (14 items), disinhibition (15 items), and executive dysfunction (17 items). Each item is rated on a 5-point Likert scale. The Spanish version (*FrSBe-Sp*) was used for this study. Cronbach's alpha was 0.84.

Ambivalent sexism

The Spanish version of the *Ambivalent Sexism Inventory (ASI)* was used to evaluate hostile and benevolent sexism (Expósito, Moya, & Glick, 1998; Cárdenas, Lay, González, Calderón, & Alegría, 2010). Participants are asked to rate 22 items on a 5-point Likert scale (0 = strongly disagree; 5 = strongly), the score ranging from 0 to 55 for each subscale (total score range: 0 – 110). Higher scores on these scales indicate higher sexism. The reliability coefficient was 0.91.

Conflict tactic measures

Revised Conflict Tactics Scales (CTS2) (Straus, 1979, 1990a) is a self-report inventory to assess how individuals choose to resolve relationship conflicts. Participants report on the behaviors of themselves and their partners during conflict. The measure consists of 78 items 8-point Likert-type, where 0 means ―This has never happened and 6 means ―More than 20 times in the past year; however, 7 means ―Not in the past year, but it happened before (Straus et al., 1990b). Cronbach's alfa was 0.92.

Attention

Attention Switching Task (ATS) measures an individual's ability to switch attention between the direction of an arrow and its location on the screen and avoiding distracting events. It is a highly cognitively demanding test as participants need to switch their attention between congruent (e.g., arrow on the right side of the screen pointing to the right) and incongruent (e.g., arrow on the right side of the screen pointing to the left) stimuli. Dependent variables considered in this study were response latencies and error scores (Cambridge Cognition Ltd, 2012).

Rapid Visual Information Processing (RVP) measures sustained attention. For this test, a white box appears in the centre of the computer screen, inside which digits, from 2 to 9, are presented in a pseudo-random order. Participants should detect specific target sequences of three consecutive digits (e.g., 2, 4, 6; 3, 5, 7 or 4, 6, 8). Dependent variables considered in this study were response accuracy, target sensitivity, and reaction times (Cambridge Cognition Ltd, 2012).

Memory

Word List is a subscale of the *Wechsler Memory Scale* (WMS)-III (Weschler, 2013). Participants are asked to recall a list of words presented five times, and each time, they have to repeat the maximum number of words that they can recall. Moreover, there is an interference list. We considered the three test conditions: immediate recall, delayed recall and recognition.

Rey–Osterrieth Complex Figure Test assesses visuospatial constructional ability and visual memory. Again, we considered all three test conditions: copy, immediate recall and delayed recall. Initially, participants must copy a stimulus card. Afterwards, the card is taken away and they are instructed to draw what they remember of the figure. Finally, participants are asked to draw the same figure again after 30 minutes (Rey, 1997).

WMS-III *Logical Memory* evaluates short-and long-term memory and recognition of two stories. Participants are asked to remember as many ideas as possible from two stories. We considered the three test conditions: immediate recall, delayed recall and recognition (Weschler, 2013).

Digit Span, a subscale of the WAIS-III, measures short-term memory, attention, and concentration. Participants are asked to repeat digits in forward and reverse order (Wechsler, 1999). We considered the three test conditions: direct order, indirect order and total score.

Letter-Number Sequencing, another subscale of the WAIS-III, measures the ability to simultaneously recall and organize stimuli (working memory). Participants are asked to repeat several series by listing the numbers in ascending order, and then the letters in alphabetical order (e.g., 9-L-2-A; correct response is 2-9-A-L) (Wechsler, 1999). We considered the total number of numbers and letters correctly recalled as dependent variables.

Spatial Span is a subscale of the WMS-III in which participants must copy a series of moves made by the evaluator with increasing difficulty. There are also two parts (forward and reverse order presentation). We considered the three test conditions: direct order, indirect order and total score (Weschler, 2013).

Executive function

Cognitive flexibility

Wisconsin Card Sorting Test (WCST) assesses the ability to set cognitive strategies in response to environmental changes. This test is made of 4 stimulus cards and 128 response cards, which contains various colours (red, blue, yellow or green), shapes (circle, cross, star or triangle) and numbers (one, two, three or four) (Heaton, Chelune, Talley, Kay, & Curtiss, 1993). Participants are asked to match the response cards to one of the stimulus cards, using cards that they think match. Firstly, the evaluator will apply the colour classification rule; then, after 10 consecutive hits, he or she will change to sorting by shape, and then to sorting by number, giving corrective feedback after each card placement, but not telling the participant the rule to follow. The dependent variables used in this test were number of total trials, number of correct trials, total errors, perseverative errors, non-perseverative errors, random non-perseverative errors, completed categories, attempts to complete the first category and failures to maintain the set.

Planning

The *Zoo test* and *Key test* are part of the Behavioural Assessment of Dysexecutive Syndrome (Wilson, Alderman, Burgess, Emslie, & Evans, 1996). The Zoo test assesses participants' ability to formulate and implement a plan and to follow a pre-formulated plan. The total score is based on the successful implementation of the plan (visiting the right places in the minimum number of moves). The *Key test* assesses their ability to plan a strategy to solve a problem (finding a key lost in a field). The total score is based on the strategy planned by participant (searching all the space provided for the test with a logic pattern).

One Touch Stockings of Cambridge (OTS) assesses spatial planning and working memory based upon the Tower of Hanoi test. The participant is shown two displays containing three coloured balls. Participants have to move the balls in the lower display to copy the pattern in the upper display. The difficulty level of the problems presented is gradually increasing. Dependent variables considered are problems solved on first choice, mean choices to correct, mean latency to first choice and mean latency to correct (Cambridge Cognition Ltd, 2012).

Decision-making

Cambridge Gambling Task (CGT) measures decision-making and risk-taking behaviour. The participant is presented with a row of ten boxes across the top of the screen, some red and some blue. At the bottom of the screen, there are rectangles containing the words ‘Red’ and ‘Blue’. Participants are asked to decide whether a yellow token is hidden in a red box or a blue box, gambling a number of points, displayed on the screen, and can select a proportion of these points, displayed in either rising or falling order, in a second box on the screen, to gamble on their confidence in this judgement. The participant should try to accumulate as many points as possible during the test. The dependent variables used in this test were delay aversion, deliberation time, proportion bet, decision–making quality, risk adjustment and risk taking (Cambridge Cognition Ltd, 2012).

Empathy

Eyes Test measures emotion decoding abilities, asking participants to identify the emotion that best represents the expression of the eyes in 36 photographs that show the eye region of the face of different men and women by choosing one of a set of four adjectives. The total score, which ranged from 0 to 36 points, is obtained by summing the number of correct answers (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001), a higher score being interpreted as indicative of stronger emotional decoding abilities.

We used the Spanish version of the *Interpersonal Reactivity Index* which measures empathic response (Mestre, Frías, & Samper, 2004). This index includes four subscales: perspective taking and fantasy (cognitive empathy); and emotional empathic concern and personal distress (emotional empathy). Responses are given on a 5-point Likert scale. The total score ranged from 7 to 35 points in each subscale, and a higher score indicates higher empathic skills. Cronbach's alpha was 0.81.

Data analysis

The Shapiro-Wilk test was used for exploring whether the data were normally distributed. After confirming normality of the data, univariate ANOVA was used to check for significant differences between the groups in age, body mass index, number of children and questionnaire scores. In addition, chi square analyses were performed for categorical variables such as socio-demographic characteristics (nationality, marital status, level of education, employment status, etc.).

Differences between groups in performance in the neuropsychological tests (attention, memory, executive functions and empathy) were examined by multivariate analyses (MANOVA). Bonferroni adjustments were applied in order to reduce the Type 1 error. For significant results, partial eta-squared was reported as a measure of effect size (η_p^2).

Data analyses were carried out using IBM SPSS Statistics for Windows, Version 22.0 (Armonk, NY, USA). P values < 0.05 were considered statistically significant. Average values are reported in tables as mean±SD.

Results

Sample characteristics

Descriptive characteristics for IPV perpetrators and controls are presented in Table 1. Groups did not differ in anthropometric or socio-demographic variables, age started drinking, duration of active drinking (years), time of alcohol abstinence (months), personal history of traumatic brain injury, or temporary loss of consciousness. For this reason, these variables were not included as covariates in subsequent analysis. Nevertheless, they differed in amount of alcohol consumption, $F(2, 97) = 12.78$, $p < .001$, $\eta_p^2 = .25$, $\beta = .99$, self-reported executive dysfunction, $F(2, 97) = 3.80$, $p = .027$, $\eta_p^2 = .09$, $\beta = .68$, and disinhibition, $F(2, 97) = 4.55$, $p = .014$, $\eta_p^2 = .11$, $\beta = .75$, with HA IPV perpetrators obtaining higher scores than the rest of the groups ($p < .05$). Moreover, a significant effect for group was found in hostile sexism, $F(2, 97) = 4.46$, $p = .015$, $\eta_p^2 = .11$, $\beta = .74$, benevolent sexism, $F(2, 95) = 12.74$, $p < .001$, $\eta_p^2 = .25$, $\beta = .99$, CTS2 psychological aggression, $F(2, 94) = 5.22$, $p = .008$, $\eta_p^2 = .14$, $\beta = .82$, and physical assault, $F(2, 94) = 4.95$, $p = .010$, $\eta_p^2 = .12$, $\beta = .80$, with IPV perpetrators (both HA and LA groups) having higher scores in all these scales than controls ($p < .05$ in all cases).

Table 1: *Mean ± SD of descriptive characteristics for all groups (*p < .05)*

	IPV perpetrators		
	High alcohol (N = 28)	**Low alcohol (N = 35)**	**Control (N = 37)**
Age (years)	40.21+11.90	39.34+9.83	41.75+11.00
BMI (Kg/m2)	22.55+3.77	23.35+4.68	24.10+4.68
Nationality			
Spanish	23 (82%)	28 (80%)	32 (86%)
Latin Americans	2 (7%)	4 (12%)	5 (14%)
Africans	3 (11%)	3 (8%)	0 (0%)
Marital status			
Single	10 (36%)	11 (31.43%)	19 (51.35%)
Married	5 (18%)	9 (25.71%)	14 (37.84%)
Separate/Divorced/Widowed	13 (46%)	15 (42.86%)	4 (10.81%)
Number of children	.80+1.304	1.50+1.732	.81+.967
Level of education			
Primary/lower secondary	20 (71.43%)	16 (45.71%)	16 (43.24%)
Upper secondary/vocational training	7 (25%)	17 (48.57%)	17 (45.95%)
University	1 (3.57%)	2 (5.72%)	4 (10.81%)
Employment status			
Employed	12 (42.86%)	16 (45.71%)	17 (45.95%)
Unemployed	16 (57.14%)	19 (54.29%)	20 (54.05%)
Income level			
1800€ – 12000€	15 (53.57%)	14 (40%)	24 (64.87%)
12000€ – 30000€	12 (42.86%)	16 (45.72%)	11 (29.73%)
30000€ – 90000€	1 (3.57%)	5 (14.28%)	2 (5.40%)
Traumatic brain injury			
Personal history of traumatic brain injury			
Yes	13 (48.14%)	14 (40%)	12 (32.43%)
No	14 (51.85%)	21 (60%)	25 (67.56%)
Temporary loss of consciousness			
Yes	8 (29.36%)	14 (40%)	13 (35.13%)
No	19 (70.37%)	21 (60%)	24 (64.86%)

Alcohol and nicotine consumption			
Age of start alcohol consumption	16.25+2.17	17.27+6.35	17.14+2.95
Time of alcohol consumption (years)	21.83+10.78	17.77+11.64	22.61+10.77
Amount of alcohol consumption*	69.10+85.60	10.17+10.85	4.90+5.04
Time of alcohol abstinence (months)	0.33+0.78	1.44+3.40	0.63+3.21
Cigarettes/day	11.50+8.92	12.33+10.67	9.09+7.07
Fagerstrom test	3.94+2.10	4.00+3.63	3.18+2.71
Frontal Behavior test			
Executive dysfunction*	42.96+10.54	36.81+8.08	37.52+7.25
ASI			
Hostile Sexism*	27.75+13.63	27.62+12.15	19.68+11.81
Benevolent Sexism*	33.03+11.35	36.11+11.72	23.17+12.27
CTS-2			
Psychological aggression*	2.92+1.99	3.14+1.97	1.54+1.43
Physical assault*	1.39+1.37	1.14+2.03	.09+.38
Criminal records different to IPV			
No	28 (84.85%)	21 (84%)	-
Yes	1 (3.03%)	0 (0%)	-
Yes, but not violence	4 (12.12%)	4 (16%)	-
Time of sentencing (months)	9.81+6.52	11.90+8.89	-

SD: standard deviation; IPV: intimate partner violence; BMI: body mass index; ASI: ambivalent sexism inventory; CTS-2: conflict tactic scale 2.

Neuropsychological assessment

Attention and memory

Attention and memory measures for all participants are summarized in Table 2.

Attention

A significant group effect was found for AST switch cost and percentage of correct responses. Specifically, the cost of shifting attention to a different stimulus was higher in HA IPV perpetrators than LA IPV perpetrators ($p = .023$) and controls ($p = .008$), while LA IPV perpetrators had a lower percentage of correct responses than controls ($p = .005$). Regarding RVP, HA IPV perpetrators performed less well in detecting the target sequences than controls ($p = .05$).

Memory

For the Wechsler Memory Scale-III Word List subscale, IPV perpetrators (both HA and LA groups) remembered fewer words than controls ($p < .001$ in all cases). Moreover, LA IPV perpetrators remembered fewer words in the first trial and in the interference list than controls ($p < .001$ and $p = .012$, respectively).

With regards to the ROCF test, HA IPV perpetrators obtained worse scores to copy the figure ($p < .001$), needed more time to copy the figure ($p = .05$) and remembered the figure less well (both short-term and long-term) ($p = .002$ in both cases) than controls. Moreover, LA IPV perpetrators also needed more time to copy the figure and remembered the figure less well (both short-term and long-term) than controls ($p = .008$ and $p = .035$, respectively).

Regarding the Logical Memory subscale, a significant effect of group was found in the first time that text A and text B were read, IPV perpetrators (both groups) remembering fewer units and topics than controls ($p < .05$ in all cases). Moreover, there were also group effects for delayed recalled of text A and B, IPV perpetrators (both HA and LA groups) obtained worse scores, meaning that they remembered both texts less well, than controls ($p < .05$ in all cases). Further, the HA group had lower scores than controls in the recognition task ($p = .035$).

In the Digits Span subscale, HA IPV perpetrators remembered fewer digits than controls especially in inverse order ($p < .05$ in all cases). Similarly, regarding the Letter-Number Sequencing subscale IPV perpetrators (both groups) remembered fewer letters and numbers than controls ($p < .001$ in all cases).

With regards to the Spatial Span subscale, group proved to be significant in inverse order and total score, with IPV perpetrators (both groups) being less able to repeat the series of movements made by the evaluator than controls ($p < .05$ in all cases). However, there were no significant differences between groups in direct order Spatial Span score.

Table 2. *Mean ± SD of attention and memory tests of all groups (*p < .05).*

	IPV perpetrators			**ANOVA statistics**		
	High Alcohol (N = 28)	**Low Alcohol (N = 35)**	**Controls (N = 37)**	**F(2, 97)**	**p**	**ηp2**
			Attention			
AST						
Switch cost*	-55.90+80.57	-134.42+123.81	-143.56+119.83	5.46	.006	.10
Percentage of correct responses*	86.48+10.96	82.69+20.71	93.47+6.56	5.36	.006	.10
Congruency cost	116.92+91.58	98.50+75.66	94.13+83.32	.62	.535	.01
RVP						

Sensitivity (from .0 to 1.00)*	0.86+0.07	0.88+0.04	0.90+0.07	2.90	.06	.06
Memory						
Word Lists test						
Total words recalled*	30.75+5.86	31.17+4.76	35.05+4.78	7.47	.001	.13
Short-term memory	7.46+2.56	7.48+2.11	8.45+1.93	2.35	.101	.05
Long-term memory	7.46+2.63	7.37+2.43	7.89+2.07	.48	.615	.01
First trial*	5.42+1.89	5.08+1.22	6.05+1.37	3.90	.023	.08
Learning curve	3.85+1.62	4.74+1.55	4.59+1.58	2.69	.073	.05
Interference list*	4.71+1.48	4.25+1.52	5.35+1.67	4.41	.015	.08
Omission	1.78+1.64	2.31+1.49	2.08+1.21	1.04	.345	.02
Recognition	22.32+1.94	22.91+1.37	23.08+1.49	1.91	.153	.03
Rey Figure						
Copy score*	32.80+3.87	34.54+2.39	35.41+1.04	8.30	<.001	.15
Copy time*	156.83+73.38	163.30+73.43	118.51+44.77	5.03	.008	.09
Short-term memory score*	20.02+6.16	20.91+6.16	25.38+6.05	7.51	.001	.13
Short-term memory time	117.15+49.63	134.05+52.24	111.92+45.59	1.95	.148	.04
Long-term memory score*	19.13+6.50	20.93+5.69	24.70+6.46	6.96	.001	.13
Long-term memory time	93.45+44.65	108.85+54.45	95.13+32.58	1.20	.304	.02
Logical Memory test						
Immediate recall:						
Total score on the first try*	21.93+10.09	21.09+7.92	27.35+6.82	6.05	.003	.11
Text A						
Units*	11.68+5.18	11.40+4.25	14.16+3.82	4.24	.017	.08
Topics*	3.96+1.75	4.31+1.89	5.43+1.21	7.47	.001	.13
Texts B						
Units*	10.25+5.31	9.69+4.44	13.19+3.72	6.31	.003	.12
Topics*	3.82+1.86	4.06+1.66	5.68+1.10	14.64	<.001	.23
Delayed recall:						
Text A						
Units*	8.07+6.079	9.32+5.02	10.92+3.77	2.70	.050	.05
Topics*	3.21+2.23	3.50+1.92	5.38+1.40	13.85	<.001	.22
Texts B						
Units*	13.29+6.42	13.06+4.75	16.62+4.94	4.91	.009	.09
Topics*	4.79+1.61	4.83+1.50	5.97+1.25	7.48	.001	.13
Recognition*	23.39+3.21	23.88+3.44	25.97+4.93	3.96	.022	.08
Digits						
Direct order	7.78+1.82	8.20+2.16	9.05+2.76	2.54	.084	.05
Inverse order*	5.67+1.96	5.91+2.17	7.03+2.16	3.96	.022	.90
Total score*	13.44+3.19	14.11+3.52	16.08+4.51	4.23	.017	.08
Letters and numbers						
Total score*	7.26+2.47	7.91+3.23	10.97+2.67	16.54	<.001	.26
Spatial location						
Direct order	8.85+1.35	8.83+2.05	9.32+1.76	.868	.423	.02
Inverse order*	6.56+2.29	6.82+2.54	8.49+2.16	6.78	.002	.13
Total score*	15.41+3.28	15.52+4.00	17.81+3.35	4.94	.009	.10

SD: standard deviation; IPV: intimate partner violence; AST: attention switching task; RVP: rapid visual processing.

Executive functions and empathic skills

Executive functions and empathic skills measures for all participants are summarized in Table 3.

Cognitive flexibility

A significant group effect was found for some WCST scales, both HA and LA IPV men needed more trials, made more errors, completed fewer categories, needed more trials to complete the first category and more often failed to maintain the set than controls ($p < .001$ in all cases). Nevertheless, groups did not differ in correct trials.

Planning

Regarding the Zoo test, in version 1 and 2, HA IPV perpetrators spend more time planning, made more mistake and obtained worse scores than controls ($p < .05$ in all cases), which means that they had more problems developing logical strategies and executing complex predetermined plans than controls. In total score of Zoo test both groups of IPV perpetrators had lower scores than controls ($p < .05$ in all cases).

There was a significant group effect for the total score on the Key test, both groups of IPV perpetrators were less able to plan a strategy to solve a problem than controls ($p < .001$ and $p = .007$, respectively). Nonetheless, no significant differences were found between groups in planning and execution time.

A significant group effect was found in the OTS problems solved on the first choice and in mean choices to correct in the third, fourth, fifth and sixth movements to correct. Both groups of IPV perpetrators required more movements to finish the exercises and achieving less good performance than controls ($p < .05$ in all cases). Nonetheless, there were no significant differences in trials which only required one or two movements. Finally, a group effect was also found for latency to first choice and latency to finish exercises correctly in exercises that need one movement. Specifically, LA IPV perpetrators took more time to do the movements than controls ($p < .001$ in all cases).

Decision making

Regarding the CGT, HA IPV perpetrators bet a higher proportion and took on more risk in their decisions than controls ($p = .024$ and $p = .019$, respectively).

Empathy

A significant group effect was found in the IRI Perspective Taking subscale, with HA IPV perpetrators presenting lower scores than LA IPV perpetrators (p = .048) and controls (p = .016). Nonetheless, groups did not differ in fantasy, empathic concern or personal distress. With regards to the Eye test, group proved to be significant, IPV perpetrators (both HA and LA groups) obtained lower scores than controls (p <.001 in all cases).

Table 3. Mean ± SD of executive functions and empathy tests scores for all groups (*p < .05).

	IPV perpetrators		**Control**	**ANOVA statistics**		
	High Alcohol (N = 28)	**Low Alcohol (N = 35)**	**(N=37)**	**F(2, 97)**	**p**	**ηp2**
Cognitive flexibility						
WCST						
Total trials*	120.21+17.10	114.26+21.80	92.31+20.76	18.52	<.001	.27
Correct trials	66.00+16.96	67.57+12.79	66.67+8.78	.12	.887	.02
Total errors*	54.21+25.20	46.69+25.30	26.05+21.93	12.75	<.001	.21
Perseverative mistakes*	25.68+11.47	27.83+17.59	13.67+13.75	9.95	<.001	.17
Non-perseverative mistakes*	28.54+18.79	19.86+11.81	11.72+10.39	12.49	<.001	.20
Completed categories*	3.43+1.97	3.57+1.88	5.38+1.53	13.39	<.001	.21
Attempts to complete the first category*	22.94+24.24	32.29+39.36	15.87+19.29	2.86	.049	.06
Failure to maintain the set*	0.81+0.92	1.37+1.61	0.26+0.59	9.09	<.001	.16
Planning						
Zoo Test						
Zoo version 1						
Planning time	48.36+24.96	63.21+36.86	59.10+25.31	1.95	.148	.04
Execution time*	92.14+82.55	85.12+48.05	57.18+34.59	3.67	.029	.07
Errors*	2.59+2.17	2.12+2.38	1.14+1.20	4.74	.011	.09
Total score version 1*	1.26+3.27	2.68+4.21	3.95+2.76	4.71	.011	.09
Zoo version 2						
Planning time*	43.49+34.29	36.39+23.12	27.70+12.08	3.53	.033	.07
Execution time	54.33+47.64	55.89+47.05	35.88+19.02	2.82	.064	.06
Errors	0.89+1.64	0.97+1.74	0.38+0.68	1.82	.167	.04
Total score version 2*	5.37+3.26	4.91+3.37	6.97+2.00	4.93	.009	.09
TOTAL SCORE ZOO TEST*	6.63+5.47	7.59+6.35	10.92+3.80	6.10	.003	.11
Key Test						
Planning time	13.24+11.95	11.15+8.42	15.48+14.72	1.14	.324	.02
Execution time	23.33+12.28	24.69+17.62	33.38+26.54	2.42	.094	.05
Total score*	6.81+3.29	8.65+3.65	11.27+3.54	13.02	<.001	.22
OTS						
Problems solved on first choice*	15.03+3,02	16.00+4,45	18.81+3,02	8.20	.001	.15
Mean choices to correct*	1.71+0.53	1.63+0.46	1.33+0.26	7.44	.001	.13

Problems with:						
1 moves	1.17+0.53	1.12+0.22	1.06+0.16	1.00	.371	.02
2 moves	1.25+0.39	1.17+0.42	1.14+0.23	.870	.422	.02
3 moves*	1.42+0.49	1.37+0.46	1.08+0.14	7.45	.001	.13
4 moves*	1.67+0.58	1.60+0.59	1.32+0.43	4.06	.020	.08
5 moves*	1.97+0.84	1.79+0.73	1.54+0.37	3.47	.035	.07
6 move*	2.79+1.15	2.72+1.08	1.86+0.94	8.35	<.001	.15
Mean latency to first choice	14673.62+7265.36	18906.10+11429.33	19947.26+11935.37	2.04	.135	.41
Problems with:						
1 moves*	8747.65+3302.95	12087.74+9363.30	6953.63+2882.28	6.51	.002	.12
2 moves	7082.91+22705.63	7825.22+23041.18	6670.26+22939.97	1.43	.243	.03
3 moves	8965.16+4337.98	10427.44+4870.10	10092.10+5970.93	.646	.527	.01
4 moves	14439.84+11311.03	16357.72+9071.56	15015.58+7736.00	.360	.699	.01
5 moves	24721.74+16877.17	26256.96+18742.32	34192.66+24228.45	2.07	.131	.04
6 move	24084.41+17827.82	40481.52+48533.45	46759.33+40024.86	2.72	.071	.05
Mean latency to correct problems with:						
1 moves*	9313.49+3694.57	14111.03+11395.22	7178.93+2924.492	8.45	<.001	.15
2 moves	8902.96+3818.69	10136.43+7401.45	7979.25+4535.23	1.35	.264	.03
3 moves	11758.40+8527.88	13884.02+8386.89	10791.31+6104.11	1.51	.225	.03
4 moves	22097.44+24259.04	22477.01+13627.41	19392.81+11787.51	.36	.699	.01
5 moves	35255.63+25785.04	35885.43+23406.45	48376.85+36049.41	2.19	.117	.04
6 moves	39906.75+28624.96	57317.70+51771.00	64303.91+39370.71	2.72	.071	.05
Decision making						
CGT						
Deliberation time	2760.89+853.10	3321.64+2190.06	2545.12+794.51	2.64	.076	.05
Proportion bet*	.62+.13	.54+.17	.51+.18	3.78	.026	.07
Quality of decision making	.84+.14	.82+.14	.84+.15	.20	.819	.01
Risk taking*	.66+.13	.58+.17	.54+.17	3.96	.022	.08
Empathy						
IRI						
Perspective taking*	20.82+4.65	23.74+5.22	23.46+4.20	4.44	.014	.08
Fantasy	16.07+4.91	19.00+4.43	19.27+6.85	3.08	.060	.06
Empathic concern	24.86+3.29	24.94+4.40	26.05+3.60	1.05	.352	.02
Personal distress	13.46+3.85	14.17+5.22	12.00+3.00	2.58	.080	.05
Eye Test						
Total score*	17.64+4.42	18.86+4.24	22.77+4.42	13.14	<.001	.21

SD: standard deviation; IPV: intimate partner violence; WCST: Wisconsin Card Sorting Test; OTS: one touch stockings of Cambridge.

Discussion

We examined neuropsychological differences between IPV perpetrators with high and low alcohol consumption and compared these groups to matched controls who were not heavy drinkers and had no history of violence. Compared to controls, HA IPV perpetrators had lower processing speed and significantly more impairments in shift attention, working and long-term memory, cognitive flexibility, planning, decision-making, perspective taking and emotion decoding skills. Furthermore, there were differences between subgroups of IPV perpetrators in shift attention and cognitive empathy, with those who were heavy drinkers (the HA IPV group) displaying more severe impairments in both cognitive domains than those who were not (the LA IPV group). In addition, the LA IPV perpetrators had significantly more impairments on working and long-term memory, executive functioning and emotion decoding skills than the controls, though they did not differ from the controls in processing speed, shift attention, decision making or cognitive empathy.

It has been postulated that violence is related to both alcohol use, and cognitive and emotional functioning (Beck & Heinz, 2013; Heinz, Beck, Meyer-Lindenberg, Sterzer, & Heinz, 2011). Our results seem to be in accordance with Alcohol Myopia Model (Bayless & Harvey, 2017; Giancola et al., 2009; 2010; 2011). In particular, the general finding that the HA IPV perpetrators had more memory, attention and processing speed impairments than controls may relate to their alcohol abuse. This finding may be an indicator of a higher risk of association between acute alcohol intoxication and the increase aggression among this group of perpetrators. The association between alcohol-related cognitive decline and aggressive behaviour following acute alcohol intake may be simply due to the fact that participants with a history of heavy or problem drinking consume alcohol more often and thus are more frequently intoxicated. Nonetheless, there were only significant differences between the HA IPV and LA IPV perpetrators in shift attention. Hence, the relationship of AUD with severe cognitive and emotional dysfunctions in IPV perpetrators is more complex than has been hypothesized.

Executive dysfunctions have been associated with impulsivity and disinhibition, especially when individuals present a chronic hazardous alcohol use. In fact, alcohol consumption might decrease behavioural control while increasing the predisposition to adopt risky behaviours and to search for extreme sensations with a total disregard for future consequences (Kravitz et al., 2015; Oscar-Berman & Marinković, 2007; Staples & Mandyam, 2016). Our results are congruent with this model in that HA IPV perpetrators had higher self-reported levels of executive dysfunction and use of aggressive strategies than controls. They also showed problems using negative feedback, suggesting an increased inflexibility to shift focus and a rigid adherence to a particular pattern, which makes it difficult for them to learn from their mistakes. This, in turn, makes it difficult for IPV perpetrators to learn from their mistakes or punishments, increasing the likelihood that they will become violent in a domestic context. Furthermore, as was previously established, low cognitive flexibility could be associated with holding sexist ideas about their partners (Romero-Martínez, Lila, Catalá-Miñana, Williams, & Moya-Albiol, 2013). While good decision making frequently requires a careful assessment of anticipated positive and negative outcomes (Gutnik, Hakimzada, Yoskowitz, & Patel, 2006; Leykin, Roberts, & DeRubeis, 2011), HA IPV perpetrators had problems developing logical strategies and they also assumed more risks in their decisions than controls. Notably, LA IPV perpetrators showed less cognitive flexibility and weaker planning skills than controls, but they did not differ from controls in decision making. Moreover, the executive dysfunction observed is relatively similar in IPV perpetrators with different levels of alcohol consumption, underscoring the view that alcohol is not the unique and determinant cause of these deficits.

Similar to the findings of Romero-Martínez, Lila, Sariñana-González, González-Bono, & Moya-Albiol (2013), of specific cognitive empathy deficits in IPV perpetrators compared to non-violent men, the current study found different patterns of empathy deficits in IPV perpetrators and in controls. In particular, HA IPV perpetrators showed significantly lower accuracy in emotion recognition and in perspective taking than controls, while compared to LA IPV perpetrators, they performed similarly in emotion recognition and significantly less well in perspective taking. In addition, as previously explained, this marked deficit in identifying emotions and in understanding others' feelings and thoughts observed in IPV perpetrators could be partially explained as a result of impaired abilities to shift attention and slow processing speed (Romero-Martínez, Lila, & Moya-Albiol, 2016a). Moreover, it has been hypothesized that empathic deficits could partially explain why certain individuals engage in risky and antisocial behaviors (van Zonneveld, Platje, de Sonneville, van Goozen, & Swaab, 2017), and this, in turns, could increase the heavy drinking (Dethier & Blairy, 2012; West, Drummond, & Eames, 1990). Nevertheless, the association between these variables (antisocial traits and empathic deficits) could be transactional. Furthermore, antisocial behaviours are considered robust predictors of IPV (Capaldi, Knoble, Shortt, &

Kim, 2012) and IPV recidivism (Romero-Martínez, Lila, & Moya-Albiol, 2016b). In this sense, our results suggest that HA IPV perpetrators may be more likely to exhibit antisocial traits and/or behaviors than the rest of participants due to their empathic impairments.

The main limitation of the study is that the sample sizes were modest, particularly in the HA IPV perpetrator group. For this reason, the findings should be considered preliminary, and further research is needed to explore these patterns in larger samples. Moreover, it is hard to make differential conclusions about the role of alcohol due to the fact that both groups of IPV perpetrators presented a similar pattern of neurocognitive deficits. Another limitation of the current study is the use of cross-sectional data rather than longitudinal data, and hence definitive conclusions cannot be drawn regarding the effects of alcohol in IPV perpetrators. Although heavy long-term alcohol users will experience a mild to moderate socio-cognitive impairments (Le Berre, Fama, & Sullivan, 2017), there are also numerous socio-cognitive impairments associated with acute alcohol intoxication (Dry, Burns, Nettelbeck, Farquharson, & White, 2012). Thus, it is difficult to differentiate between long-term effects of alcohol abuse on cognition from acute-effects of intoxication and their interactions. Further, it would be useful to analyze how certain personality traits like antisocial would predict the neuropsychological deficits presented in our study. Another limitation is the absence of a non-violent alcoholic control group. Although we initially collected inpatients from an alcohol abuse clinic, the majority of those who participated in our study were in an abstinence period higher than twelve months. However, IPV perpetrators who participated in our study actively consume alcohol. For this reason, these groups were not directly comparable. Moreover, it should be mentioned that IPV perpetrators who participated in our study did not suffer from any mental illness and had no previous criminal record, which could indicate that these participants presented less severe violence than typical IPV arrestees and they're only men. Hence, future studies should consider analyzes neuropsychological deficits in different IPV perpetrators subgroups. Finally, we did not employ the same classification criteria as in previous studies (Romero-Martínez et al., 2013a; 2013b; 2016). Specifically, previously, the Alcohol Use Disorders Identification Test (AUDIT) (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001) scores were used to screen for alcohol misuse, while in this new research, we classified groups based on alcohol intake and DSM-5 diagnostic criteria for AUD. Thus, it is important to note the need to homogenize the criterion of classification of the groups of IPV perpetrators across studies in order to extend the external validity of results.

On the other hand, this study has a number of strengths. First, our data are novel in that no previous studies have examined neuropsychological functioning with an established neuropsychological battery among different types of IPV perpetrators and matched controls. Thus, our findings could be considered for developing specific cognitive rehabilitation programs adjuvant to the psychotherapeutic intervention for IPV perpetrators. Second, in relation to methodology, we combined a rapid exhaustive computer-based neuropsychological assessment battery with pencil-and-paper measures. This study is part of an ongoing research effort to improve our understanding of why IPV perpetrators use violence against their partners. Thus, future research should aim to provide a more nuanced look at the role of neuropsychological functioning in IPV as well as protective factors that prevent other men with poor neuropsychological functioning from engaging in IPV.

Conclusions

The current findings have important implications for prevention and treatment. Regarding preventive practice, analysis of executive functions and impulsivity may prove useful in detecting individuals at high risk for IPV, and should be further investigated within the context of early screening and risk prediction. With respect to treatment, many interventions for IPV perpetrators rely on changes in cognition and behaviour that may be very difficult for individuals with subtle cognitive and emotional impairments to implement effectively. For example, individuals with low cognitive flexibility may have considerable difficulty considering alternative interpretations or implementing alternative responses in the context of an angry reaction to an intimate partner. Moreover, they also may have difficulty switching from an unproductive cognitive reaction or behavioural strategy to a more adaptive response due to perseveration and inflexibility. Hence, the current findings suggest that IPV perpetrators with neuropsychological difficulties, especially those who are heavy drinkers, may have the greatest need for cognitive interventions, but may also face the greatest challenges in implementing cognitive change strategies. Professionals working with IPV perpetrators in a clinical context should consider the potential impact of neuropsychological functioning when tailoring interventions. Nonetheless, IPV perpetrators represent a very heterogeneous group and clinicians should understand that problems with neuropsychological functioning do not account for all abusive behaviour or anger difficulties.

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Chapter 3

Study 2: The role of mental rigidity and alcohol consumption interaction on intimate partner violence: A Spanish study

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Introduction

Intimate partner violence (IPV) is a serious public health problem worldwide. It is estimated that 35% of women have experienced dating violence or sexual violence by others at some point in their life, and as many as 38% of murders of women are committed by their own partners (World Health Organization [WHO], 2013). This type of violence causes serious physical, psychological, sexual, and reproductive health problems in victims (Martínez, Sánchez, & Blasco, 2010). As reported, it has high economic and social costs in Western societies (WHO, 2013).

Cognitive deficits mostly related to neurological alterations increase proneness to violence (Pinto et al., 2010; Teichner, Golden, van Hasselt, & Peterson, 2001). In particular, dysfunctions in the prefrontal cortex facilitate aggression and violence (Becerra-García, 2015; Koenings et al., 2007; López-Caneda et al., 2014; Moya-Albiol, 2010; Walling, Meehan, Marshall, Holtzworth-Munroe, & Taft, 2012). The prefrontal cortex is mainly responsible for executive functions, which are usually associated with behavioral regulation and social adjustment. They include several cognitive processes required to orient behavior toward a goal, such as decision making, abstract thinking, and formulation and execution of plans, as well as mental rigidity (Buller, 2010). Mental rigidity has an important role adjusting behavior under conditions of changing environmental demands (Grant & Berg, 1948; Teichner et al., 2001). Thus, high mental rigidity indicates a lack of flexibility in self-regulated behavior. Moreover, the mental rigidity has been defined in the Wisconsin card sorting test (WCST) as a difficulty in using the negative feedback productively suggesting a rigid adherence to a specific pattern and a decreased ability to shift focus (Heaton, Chelune, Talley, Kay, & Curtiss, 2009; Romine et al., 2004; Steinglass, Walsh, & Stern, 2006). This, in turn, makes it difficult for IPV perpetrators to learn from their mistakes or punishments, increasing the risk of recidivism (Heinz, Beck, Meyer-Lindenberg, Sterzer, & Heinz, 2011; Romero-Martínez, Lila, Catalá-Miñana, Williams, & Moya-Albiol, 2013a; Teichner et al., 2001).

Mental rigidity has been negatively related to both cognitive and emotional empathy (Thoma et al., 2011). Consistent with this, high mental rigidity may lead to greater difficulties with emotional empathy as men with high mental rigidity show impairment in emotional decoding abilities (Romero-Martínez, Lila, Martínez, Pedrón-Rico, & Moya-Albiol, 2016; Thoma, Friedmann, & Suchan, 2013). This deficit could generate misunderstandings, giving a negative connotation to the intentions or feelings of their partners and promoting inappropriate reactions, anger expression, or violent behavior in stressful or tense situations. In this regard, previous studies have pointed out that stronger feelings of anger alter normal cognitive processes in ways that would increase levels of sympathetic arousal and otherwise motivate aggressive behaviors (Houston, 1994).

Moreover, men with higher mental rigidity and empathy deficits habitually hold stereotypes and sexist ideologies that resist change, appearing as hostile sexism in the case of IPV perpetrators (Romero-Martínez et al., 2013a; Teichner et al., 2001). Hostile sexism includes prejudicial attitudes and discriminatory behaviors based on a supposed inferiority of women. This form of prejudice includes intolerance and antipathy that would include the wish for obedience and subordination (Cárdenas, Lay, González, Calderón, & Alegría, 2010; Lila, Gracia, & García, 2013a). In IPV perpetrators, hostile sexism could entail a lower perception of the severity of their actions, given their perception of female inferiority, and a greater tendency to blame the victim, meaning that they feel less sense of personal responsibility (Gracia, García, & Lila, 2011; Gracia & Herrero, 2006; Gracia & Tomás, 2014; Lila et al., 2013a).

Other factors could modulate the relationship between mental rigidity and violence, alcohol consumption being one of the most studied (Eckhardt, Parrott, & Sprunger, 2015). Alcohol acts as a depressor of the central nervous system, mainly by inhibiting the functioning of the prefrontal cortex. Namely, in chronic alcohol consumers the effects of alcohol could alter the normal functioning of cognitive processes required to adjust behavior (López-Caneda et al., 2014; Romero-Martínez et al., 2013a). Although there is not a direct causal relation between alcohol and violence, a high proportion of IPV perpetrators present with frequent alcohol consumption and/or commit violent acts under the influence of alcohol (López-Caneda et al., 2014).

The main aim of this study was to assess cognitive differences between IPV perpetrators with low and high mental rigidity, using socio-cognitive variables that could be related to a higher predisposition to violence. We hypothesized that men with a low level of mental rigidity would present more cognitive empathy (Thoma et al., 2011), less hostile sexism (Romero-Martínez, Lila, Sariñana-González, González-Bono, & Moya-Albiol, 2013b; Teichner et al., 2001) and lower trait anger and levels of anger expression (Romero-Martínez et al., 2013b) than men with a high level of mental rigidity, and that the latter would tend to minimise or deny the severity of their violent behavior (Gracia et al., 2011; Lila et al., 2013a). Further, we assessed differences in alcohol consumption among the men with low and high mental rigidity. We expected to find that IPV perpetrators with low levels of mental rigidity would report lower alcohol consumption than those with high levels of mental rigidity (Romero-Martínez et al., 2013a).

Method

Participants

The final sample was composed of 136 IPV perpetrator men who participated voluntarily in the study. Seventy participants were excluded from the analysis because they did not complete the neuropsychological or psychological assessment. All participants were recruited from the community and psychoeducational treatment program, Contexto, at the Department of Social Psychology of the University of Valencia (Spain). This is a court-mandated program for men sentenced to less than 2 years in prison for violence against women in intimate relationships. For this reason, participants had their sentence suspended on the condition that they attended an intervention program (Lila, 2013; Lila et al., 2010; Lila, Gracia, & Herrero, 2012; Lila, Oliver, Galiana, & Gracia, 2013b). Requirements for participating included: having being jailed for IPV; not having been convicted for assault outside the home; and not being diagnosed of any mental illness, assessed with the SCL-90-R (González De Rivera et al., 1989). All participants were interviewed by trained researchers (with extensive experience treating IPV perpetrators) to assess their mental health. Candidates were eligible to participate if the qualitative interviews and SCL-90-R scores confirmed they were free of mental illness. All participants were adult men ages 21–78 years, with a mean age of 43.24 years (SD = 10.87), all living in the Valencian region (Spain). Those included in our study did not have a previous criminal record or any physical or mental illness.

All participants were properly informed about the research protocol and gave written informed consent. The research was conducted taking into account current ethical and legal guidelines on the protection of personal data and research with human beings in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of the University of Valencia (H1348835571691).

Procedure

Considering the efficiency of the procedure followed in previous studies, and in order to avoid fatigue and interferences among questionnaires (Romero-Martínez et al., 2013a, 2013b, 2014), all participants attended three sessions at the Faculty of Psychology of the University of Valencia before they started the Contexto intervention program to minimize possible effects of fatigue later in the day. In the first session, participants were interviewed to exclude those with organic diseases (SCL-90-R) and socio-demographic data were collected through a semi-structured interview. In addition, alcohol consumption was assessed using the Spanish versions of the Alcohol Use Disorders Identification Test (AUDIT) questionnaire. In the second session, a range of cognitive and psychological variables were assessed, including mental rigidity with the WCST and emotional empathy with the Reading the Mind in the Eyes (Eyes Test) and the Interpersonal Reactivity Index (IRI). In the third session, trait anger and anger expression were evaluated with the State-Trait Anger Expression Inventory-2 (STAXI-2), hostile sexism with the Ambivalent Sexism Inventory (ASI) and perception of violence severity with the Victim-blaming attitudes (VIDO).

Mental rigidity

The WCST evaluates abstract reasoning and the ability to change cognitive strategies in response to environmental changes (mental rigidity). It consists of four stimulus cards and 128 response cards containing various colors (red, blue, yellow, or green), shapes (circle, cross, star, or triangle), and numbers (one, two, three, or four) of figures (Heaton et al., 2009). The participants have to match the response cards to one of the stimulus cards, using cards that they think match. First, the evaluator will apply the color classification rule; then, after 10 consecutive hits, he or she will change to sorting by shape, and then to sorting by number, giving corrective feedback after each card placement, but not telling the participant the rule to follow. The WCST is scored in terms of the number of correct responses and the number of perseverative errors during the test. Participants with more correct responses and lower perseverative errors have been considered less rigid mentally in comparison with those with less correct responses and high number of perseverative errors.

Empathy

The Eyes Test measures emotional decoding. Participants have to identify the emotion that best represents the expression of the eyes in 36 photographs that show the eye region of the face of different men and women. The participants have to choose one of a set of adjectives, and the total score is obtained by summing the number of correct answers (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001). The scores can range from 0 to 36 points. A higher score could be interpreted as a better emotional decoding process.

The IRI (Davis, 1983) assesses the empathic response. It includes four subscales: two for evaluating cognitive empathy (perspective taking and fantasy) and two for emotional empathy (empathic concern and personal distress). Responses are given on a 5-point Likert scale. In this study, we used the Spanish version (Mestre, Frías, & Samper, 2004). Possible scores on this measure range from 7 to 35 points in each subscale; therefore, a higher score has been interpreted as better empathy ability. Reliability coefficients ranging from .55 to .66 and adequate validity (communality analyses > .4, KMO > .5, and Bartlett's sphericity test < .05).

Alcohol consumption

The Spanish version of the AUDIT (Contell-Guillamón, Gual-Solé, & Colom-Farran, 1999) was used to evaluate the quantity and frequency of alcohol use in adults. It has been developed by the WHO to identify when alcohol consumption becomes hazardous or harmful for health. It is composed of 10 self-report items with response options ranging from 0 (never) to 4 (daily or almost daily; Babor & Grant, 1989), possible scores on this measure rage from 0 to 40. In this test, a higher score indicates harmful alcohol consumption to participants' health. Cronbach's alpha was .77 and validity was adequate (communality analyses > .4, KMO > .5, and Bartlett's sphericity test < .05).

Trait anger and anger expression

The STAXI-2 assesses trait anger and its expression (Spielberger, 1999). It is composed of two subscales for evaluating the anger trait (temperament and reaction) and four for anger expression (anger expression out, anger expression in, anger control out, and anger control in). For the present study, responses to these scales were combined into a single variable called Trait Anger (T-Ang). In addition, a general anger expression index (AEI) was calculated by summing the scores on the two expression subscales and subtracting the score on the two control scales, and finally adding 36 units to avoid negative scores. In this study, we used the Spanish version (Miguel-Tobal, Casado, Cano-Vindel, & Spielberger, 2001). The scores can range from 0 to 72, with high scores showing more anger expression. Psychometric data were adequate in reliability (Cronbach's alpha ranged from .67 to .89) and validity (communality analyses > .4, KMO > .5, and Bartlett's sphericity test < .05).

Sexism

The Spanish version of the ASI was used to evaluate hostile and benevolent sexism (Expósito, Moya, & Glick, 1998). Participants are asked to rate 22 items on a 5-point Likert scale (0 = strongly disagree; 5 = strongly agree), scores can range from 0 to 55 in each subscale (0–110 total scale possible score range). A higher punctuation in these scales indicates a major sexism ideology in participants. Psychometric data were adequate in reliability (Cronbach's alpha were .99 and .86, respectively) and validity (communality analyses > .4, KMO > .5, and Bartlett's sphericity test < .05).

Perception of violence severity

The VIDO questionnaire evaluates the perceived severity of violence (Gracia & Tomás, 2014). Participants are asked to rate eight items concerning different situations of violence against women on a severity scale of 1 to 10. The final score is calculated by summing the scores on all items. The scores can range from 8 to 80, with a high score interpreted as high perceived severity of violence. Psychometric data were adequate in reliability (Cronbach's alpha was .90) and adequate validity (communality analyses > .4, KMO > .5, and Bartlett's sphericity test < .05).

Data analysis

To classify participants as having high or low mental rigidity, K-means clustering was performed employing two of the scores obtained on the WCST: (a) number of attempts and (b) number of perseverative errors. K-means clustering technique allows grouping the participants taking into account variables that characterize them, forming groups with a high degree of internal homogeneity and external heterogeneity. The low mental rigidity (LMR) group (n = 75) was composed of participants who made the smallest number of attempts, scores in this group ranged from 72 to 128 (M = 111.41 ± 21.05), and perseverative errors, scores ranged from 6 to 37 (M = 19.01 ± 10.77). Whereas the high mental rigidity (HMR) group (n = 61) was formed by those who made the most attempts, all participants in this group obtained a score of 128 (M = 128 ± .00) and perseverative errors, scores ranged from 25 to 94 (M = 47.52 ± 18.14).

Data was normally distributed using Kolmogorov-Smirnov statistics (p > .05). t-Tests were carried out to detect significant differences between groups in quantitative variables as age, empathy, anger trait and expression, ambivalent sexism, and perception of violence severity. Effect sizes for the between-group differences were calculated using Cohen's d. Chi square analyses were performed for categorical variables as demographic variables (marital status, level of education, and employment status).

All statistical analyses were performed with the IBM SPSS Statistics for Windows, Version 22.0 with the alpha level set at .05 and a confidence level of 95%.

Results

Descriptive characteristics and neuropsychological measures for all participants are summarized in Table 1. No significant differences were found between IPV perpetrators with LMR and HMR in age, marital status, education level, and employment status.

There were differences among groups in alcohol consumption. LMR participants reported lower alcohol consumption than those categorized as HMR, $t(90.591) = 2.261$, $p = .026$, $d = .475$, $P = .94$.

Groups differed in Eye Test scores, $t(113.659) = -3.462$, $p = .001$, $d = .649$, $P = .99$, and in IRI perspective taking, $t(134) = -2.036$, $p = .044$, $d = .351$, $P = .87$, IPV perpetrators with LMR showing higher empathy than those with HMR.

On the other hand, there were significant differences between groups in anger trait scores, $t(95.281) = 1.977$, $p = .050$, $d = .405$, $P = .87$, and anger expression scores, $t(133) = 1.903$, $p = .051$, $d = .330$, $P = .81$. Thus, the LMR group presented lower punctuation in both variables than the HMR group.

Finally, the LMR group obtained lower scores in hostile sexism, $t(134) = 1.996$, $p = .048$, $d = .344$, $P = .85$, and had a greater perception of violence severity, $t(105.219) = -2.309$, $p = .023$, $d = .450$, $P = .94$, than the HMR group.

Table 1. *Mean ± SD of descriptive characteristics and psychological measures for groups with low and high mental rigidity. * p < .05, ** p < .001.*

	Low mental rigidity (N = 75)	**High mental rigidity (N = 61)**
Age (years)	42.25+10.45	44.44+11.33
Marital status		
Married	26 (34.7%)	13 (21.3%)
Single	20 (26.7%)	20 (32.8%)
Separate	7 (9.3%)	8 (13.1%)
Divorced	21 (28%)	20 (32.8%)
Widower	1 (1.3%)	0 (0%)
Level of education		
Primary/lower secondary	41 (54.7%)	40 (65.5%)
Upper secondary/vocational training	28 (37.3%)	17 (27.9%)
University	6 (8%)	4 (6.6%)

Employment status		
Employed	41 (54.7%)	32 (52.5%)
Unemployed	34 (45.3%)	29 (47.5%)
AUDIT*	4.03+3.57	6.03+6.08
Eye Test**	19.33+3.48	16.95+4.36
IRI		
Perspective taking*	23.16+5.25	21.46+4.28
Fantasy	16.61+5.11	16.41+5.13
Empathic concern	25.19+4.09	24.10+4.47
Personal distress	15.91+4.64	15.82+3.93
STAXI-2		
T-Ang*	14.80+3.37	16.39+5.51
AEI*	22.52+10.23	26.15+11.90
ASI		
Hostile sexism*	26.36+12.80	30.97+14.07
Benevolent sexism	33.25+12.68	34.03+13.20
VIDO*	72.44+11.06	66.98+15.52

Discussion

As hypothesized, in the present study, IPV perpetrators with LMR had greater empathic abilities and greater perception of the severity of the IPV committed, and lower alcohol consumption, trait anger, anger expression, and hostile sexism than those with HMR. The study's statistical power ranged from 81 to 99, which means that it was adequate to demonstrate our hypotheses.

Perpetrators with LMR showed stronger emotional decoding abilities and this could facilitate the maintenance of appropriate social relationships. Emotional empathy is essential to recognize one's own intentions and feelings and those of others, and to avoid violent behavior in tense situations or conflicts with partners (Romero-Martínez & Moya-Albiol, 2013; Thoma et al., 2013). This relation between violence and empathy is currently being studied from a psychobiological perspective, and some important results indicated that violence and empathy share the same brain structures (Moya-Albiol, 2011). Consequently, the same neuronal circuits could control the capacity to understand the feelings and thoughts of other people and also the capacity to attack them (Moya-Albiol, 2014).

Alcohol consumption modulates the relationship between mental rigidity and IPV (Eckhardt et al., 2015; López-Caneda et al., 2014). In our study, IPV perpetrators with LMR reported lower alcohol consumption than those with HMR. Hence, although alcohol consumption is not a direct causal factor, its effects on the brain could facilitate the perpetration of violence. A previous study analyzed neuropsychological differences between

IPV perpetrators with low and high alcohol consumption, and the latter were found to have higher scores in impulsivity, hostile sexism, and trait anger (Romero-Martínez et al., 2013a).

In relation to this, men with less empathy are also those who have higher levels of anger expression. IPV perpetrators with LMR showed lower trait anger and anger expression than those with HMR. Anger has been related to a series of personal features that impair the cognitive process (Houston, 1994). In line with this, previous research found higher trait anger in IPV perpetrators than in a control group (Romero-Martínez et al., 2014). Anger is generally regarded as an affective psychological feature, and it has been related to feelings, such as contempt, resentment, and/or disgust.

According to previous studies (Romero-Martínez et al., 2013a; Teichner et al., 2001), IPV perpetrators with LMR report less hostile sexism than those with HMR. The maintenance of such negative ideologies about women makes abusers dismiss the importance to their acts of violence (Cárdenas et al., 2010). In relation to this, IPV perpetrators with LMR showed a greater perception of the severity of IPV. To recognize IPV as a serious transgression is likely to be a variable that contributes to avoiding the perpetration and recidivism of this kind of violence (Gracia et al., 2011; Gracia & Herrero, 2006; Gracia & Tomás, 2014; Lila et al., 2013a). This could be a very important issue to bear in mind in future intervention programs attempting to minimize violence recidivism.

Although this study represents an advance in our understanding of factors predisposing to IPV, its limitations should be taken into account in interpreting the results and designing future studies. Some variables were assessed using self-report questionnaires, and a high need for social desirability in IPV perpetrators could lead them to provide incorrect answers. Moreover, the sample was composed of IPV perpetrator men who participated voluntarily in the study but is not a random sample. Although we did not find differences between groups in educational level, future studies could analyze the influence of this issue and general intelligence in mental rigidity, due to their importance for executive functions. Moreover, analyzing other psychobiological variables could help to define a more complete perpetrators' profile, which in turn, permits one to explore neurobiological mechanisms involved in IPV. Nevertheless, these variables should be considered complementary to psychological and gender relationship variables.

An increased understanding of IPV may enable the development of prevention and intervention programs based on a more prescriptive, empirically based approach.

Specifically, the understanding of the potential role of psychobiological variables, such as those analyzed in our study, would enable us to develop more adapted and effective prevention and treatment programs for IPV, the establishment of criteria for inclusion in such programs, the identification of differences between IPV perpetrators, leading to the definition of typologies, and also the assessment of the intervention programs effectiveness.

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Chapter 4

Study 3. Cognitive profile of long-term abstinent alcoholics in comparison with non-alcoholics

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Introduction

Several studies have demonstrated that long-term chronic alcoholism is associated with potentially long-term deleterious effects on neuropsychological functioning (Le Berre, Fama, & Sullivan, 2017; Stavro, Pelletier, & Potvin, 2013; Valmas, Mosher-Ruiz, Gansler, Sawyer, & Oscar-Berman, 2014), but these deficits depends on variables such as drinking patterns (the amount, type, frequency...), the age of initiation of alcohol; the duration of the hazardous and harmful alcohol consumption and the alcohol abstinence (Bernardin, Maheut-Bosser, & Paille, 2014; Sullivan, Rosenbloom, Lim, & Pfefferbaum, 2000a; Sullivan, Rosenbloom, & Pfefferbaum, 2000b; Rosenbloom, O'Reilly, Sassoon, Sullivan, & Pfefferbaum, 2005). Given that alcoholic cognitive deficits are not evently distributed among individuals, it has been suggested that long-term alcohol abusers vary along of a continuum (Bates, Voelbel, Buckman, Labouvie, & Barry, 2005; Oscar-Berman, Valmas, Sawyer, Ruiz, Luhar, & Gravitz, 2014).

Unfortunately, there are several limitations in the study of cognitive function in abstinence. In fact, it remains unclear the time of abstinence needed for normalization of cognitive function and which cognitive domains improve during this period of abstinence (Pelletier, Nalpas, Alarcon, Rigole, & Perney, 2016). Although several studies have shown certain improvements in specific cognitive domains such as visuospatial capacity, memory, and executive function after the first months to one year of abstinence (Alhassoon et al., 2012; Bernardin et al., 2014; Erickson & White, 2009; Oscar-Berman et al., 2014; Pfefferbaum, Adalsteinsson, & Sullivan, 2006; Sullivan et al., 2000a; Sullivan et al., 2000b), a recent meta-analysis suggested persistent dysfunctions in multiple cognitive processes after months of alcohol abstinence (Stavro et al., 2013). Impairments and/ or improvements in each cognitive ability may differ depending on the recovery rate of each brain system, which underlie to these cognitive processes (Kish, Hagen, Woody, & Harvey, 1980; Pelletier et al., 2016; Pfefferbaum, Sullivan, Mathalon, Shear, Rosenbloom, & Lim, 1995; Stavro et al., 2013; Yohman, Parsons, & Leber, 1985).

Alcohol-related cognitive deficits may explain why therapeutic programs are not adequately processed (e.g., low participation in therapeutic workshops, absence of recording of therapeutic advice...), which in turn affect the effectiveness of rehabilitation programs due to the complexity in therapy programs (Berking, Margraf, Ebert, Wupperman, Hofmann, y Junghanns, 2011). Hence, a wider knowledge of cognitive and affective deficits could be employed to guide the development of early coadjuvant treatments, which allows to improve the affected cognitive domains and in turn reduce the rate of alcohol recidivism.

The current study was designed to address this gap in our understanding by investigating differences between long-term abstinent alcoholics (LTAA) and non-alcoholic individuals (control group), to establish differential neuropsychological profiles. In the light of previous findings regarding persistent cognitive impairments in patients with alcohol use disorders (AUD) after long-term periods of abstinence (Alhassoon et al., 2012; Fein, Torres, Price, & Di Sclafani, 2006; Munro, Saxton, & Butters, 2000; Nowakowska-Domagała, Jabłkowska-Górecka, Mokros, Koprowicz, & Pietras, 2017; Pfefferbaum et al., 2006; Stavro et al., 2013; Yohman et al., 1985), we hypothesized that LTAA would manifest neuropsychological dysfunctions relative to controls. The analysis of these cognitive profiles in LTAA are crucial for the patient's participation in relapse prevention programs.

Method

Participants

The final sample was composed of 79 men who participated voluntarily in the study: 40 LTAA and 39 individuals with no history of alcohol or drug consumption, as the control group. LTAA participants were recruited from Asociación Valenciana de Ex-Alcohólicos (*AVEX)*, which offer a psychoeducational treatment program conducted by two psychotherapists. Moreover, participants were also recruited from the community by postings at Alcoholics Anonymous (AA) meetings, mailings and subject referrals. Inclusion criteria in the current study were diagnosis of Alcohol Use Disorder (AUD) assessed by the DSM 5; participants who have been abstinent for a minimum of twelve months (Fein et al., 2006); age above 18 and less than 60 years old; and ability to understand and speak Spanish. Exclusion criteria were suffer from any neurologic or psychiatric disease such as Alzheimer's or any type of dementia, past history of stroke or brain injurys, encephalopathy, and refusal to participate. All the individuals who were candidate participants were interviewed by trained researchers (with extensive experience treating AUD) to assess their mental health. Cohen's kappa, used to assess inter-rater agreement between qualitative interviewers in the nine psychopathological dimensions evaluated (the same dimensions as the Symptom Checklist 90-R, SCL-90-R), ranged from .67 to .84. Regardless of the SCL-90-R scores, the interviewees were considered not to have any psychopathological signs and symptoms if they scored less than the mean for their age for each dimension. They were then considered eligible to participate if the qualitative interviews and SCL-90-R scores confirmed they were free of mental illness. Four LTAA participants and five controls were excluded because their results suggested psychological disorders and additional current drug abuse.

Controls were recruited via internet advertisements and posting flyers around our city from January, 2016 to August, 2016. They were matched on socio-demographic characteristics. Furthermore, it would be necessary that they present alcohol consumption lower than 30 g/day, and less than two DSM-5 symptoms of AUD. High alcohol consumption was operationally defined as alcohol intake higher than 30 g/day (Cao, Willett, Rimm, Stampfer, & Giovannucci, 2015; Cho, Lee, Rimm, Fuchs, & Giovannucci, 2012; Scoccianti et al., 2016).

All participants were right-handed and healthy, were properly informed about the research protocol and gave written informed consent. The research was conducted taking into account current ethical and legal guidelines on the protection of personal data and research with human beings in accordance with the Declaration of Helsinki and was approved by the University of Valencia Ethics Committee (H1348835571691).

Procedure

All participants attended three sessions at the Faculty of Psychology. In the first session, participants were interviewed to exclude those with organic diseases and socio-demographic data were collected through a semi-structured interview. Then, participants were asked about their consumption of alcohol and cigarettes, in terms of both the amount consumed and how long they had been abstinent. Moreover, it was employed a breathalyzer to assess whether participants present a 0,0% alcohol concentration. Subsequently, they completed an inventory based on DSM-5 to check for the presence of AUD, and the Fragerström test of nicotine dependence to assess addiction level. Lastly, they were asked if they had a history of traumatic brain injury, noting whether they had lost consciousness during the trauma; for example, had they been involved in fights, and if so, how often had this resulted in head injuries and had they had blackouts after these injuries. In fact, there were excluded those participants who suffered a severe TBI. Finally, other psychological tests were studied in order to complete participant's profile.

The second and third sessions spread over two consecutive days, a range of neuropsychological variables were assessed using traditional tests and also the computer-based Cambridge Neuropsychological Test Automated Battery (CANTAB) ordered as presented in table 1. This neuropsychological testing was build based on Ruiz-Sánchez de León, Pedrero-Pérez, Rojo-Mota, Llanero-Luque, & Puerta-García (2011) recommendations. If any of participants was a smoker, he was asked to smoke previously to the neuropsychological assessment to avoid any bias related to the abstinence of nicotine

The end of the assessment was marked by displaying a sign saying "Thank you very much", participants were paid €20 for their participation and told that they could leave.

Frontal Behaviour

Spanish version of *Frontal Systems Behaviour Scale (FrSBe)* is composed of 46 items that measure frontally-based behavioural syndromes such as disinhibition (15 items), apathy (14 items) and executive dysfunction (17 items) (Pedrero-Pérez, Ruiz-Sánchez de León, Llanero-Luque, Rojo-Mota, Olivar-Arroyo, & Puerta-García, 2009), all being rated on a 5-point Likert-type scale (1 = 'not at all' to 5 = 'very much so').

We used the translated into Spanish version of the Montreal cognitive assessment (MoCA) (http://www.MoCAtest.org/). The MoCA measures eight cognitive domains such as naming, attention, language, abstraction, delayed memory, orientation, visuospatial and executive abilities. The initially proposed normal MoCA score is ≥ 26, but a point must be added to the total score in participants with low educational level (less than 12 years of education).

IQ (abstract reasoning and processing speed) (table 1)

Abstract reasoning and processing speed were measured by the subtests matrix reasoning, digit symbol-coding, symbol search and similarities of the WAIS-III (Wechler, 1999).

Attention (table 1)

We employed the translated version into Spanish of the d2 test, which measures the ability to focus on relevant stimulus while ignoring irrelevant (Seisdedos, 2004). It consists in 14 lines with 47 characters each one, which contains letters such as «d» and «p». Participants should check during 20 seconds for each line from left to right, the contents of each line marking only «d» showing two little dashes (both above, below or one above and one below). Dependent scores for this study were: TR, overall answer; TA, number of correct guesses; O, omitted elements; C, commissions; TOT, total test effectiveness; and CON concentration index.

Attention Switching Task (ATS) measures the ability to switch attention between the direction of an arrow and its location on the screen and avoiding distracting events. It is a highly cognitive demanding test as participants should switch their attention between congruent (e.g., arrow on the right side of the screen pointing to the right) and incongruent stimuli (e.g., arrow on the right side of the screen pointing to the left) presentation. Dependent variables for this study were switch cost, percentage of correct responses and congruency cost (Cambridge Cognition Ltd, 2012).

Rapid Visual Information Processing (RVP) measures sustained attention. This test consists in a white box appears in the center of the computer screen, inside which digits, from 2 to 9 are presented randomized. Subjects should detect specific target sequences of three consecutive digits (e.g., 2,4,6; 3,5,7 and 4,6,8). Dependent variable for this study was target sensitivity.

Choice Reaction Time (CRT) is a 2-choice reaction time test that assesses attentional ability and reaction times, which includes a practice stage of 24 trials and two assessment stages of 50 trials each. Dependent variables for this study were percentage of correct answers and mean correct latency (ms) (Cambridge Cognition Ltd, 2012).

Memory (table 1)

Word List is a subscale of the WMS-III (Wechler, 1997). Participants must recall a list of words presented five times, and each time, the participant has to repeat the maximum number of words that he/she can recall. Moreover, there is an interference list. This test consists of three test conditions: immediate recall, delayed recall and recognition.

Rey–Osterrieth Complex Figure Test assessed visuospatial constructional ability and visual memory. This test consists of three test conditions: copy, immediate recall and delayed recall. Initially, participants must copy a stimulus card. Afterwards, the card is taken away and they are instructed to draw what they remember of the figure. Finally, participants must draw the same figure once again after 30 minutes.

WMS-III *Logical Memory* evaluates short and long-term memory and recognition of two stories. Participants should remember as many ideas as possible from two stories (Wechler, 1997).

Digit Span is a subscale of the WAIS-III, which measures short-term memory, attention, and concentration. Participants are asked to repeat digits in direct and inverse order (Wechsler, 1999).

Letter-Number Sequencing is a subscale of the WAIS-III, which measures the ability to simultaneously recall and organize stimuli (working memory). Subject should repeat several series by repeating the numbers in ascending order, and then the letters in alphabetical order (e.g., 9-L-2-A; correct response is 2-9-A-L) (Wechsler, 1999).

Spatial Span is a subscale of the WMS-III, in which participants must copy a series of moves made by the evaluator with increasing difficulty. There are also two parts (direct and inverse order).

Spatial Span Test from the CANTAB measures working memory capacity. It has been presented white squares, some of which briefly change colour in a variable sequence. This test is stopped when the subject fails three consecutive trials at any specific level. The maximum number of boxes correctly defines the final score obtained (Cambridge Cognition Ltd, 2012).

Executive function tests (table 1)

Verbal fluency

Semantic categorial evocation of animals consists of asking the patient to say as many animal names as he can in about 60 seconds. It has been assigned 1 point for each correct animal name evoked in that time interval, without a maximum score (Del Ser Quijano, Sanchez Sánchez, Garcia de Yebenes, Otero Puime, Zunzunegui, & Muñoz, 2004). Moreover, in the F-A-S verbal phonemic fluency participants must produce as many words as possible with each of the three test letters previously presented during 60 seconds each one.

Inhibition

The Stroop color and word test measures the ability of divided attention and resistance to interference (Spreen & Strauss, 1991).

For the assessment of verbal inhibition we employed the Hayling test (Burgess & Shallice, 1997).

Cognitive flexibility

For *Design fluency* was employed the Five-Point test, which involves the uses of a structured background that consists of a sheet of paper with 40-dot matrices (five columns x eight rows). Participants should draw as many different figures as possible by connecting any numbers of dots from the 5 dots within each cell to create novel designs within 60 seconds (Lezak, 2004).

Wisconsin Card Sorting Test (WCST) measures abstract reasoning and the ability to change cognitive strategies in response to environmental changes. It consists of 4 stimulus cards and 128 response cards containing various colours (red, blue, yellow or green), shapes (circle, cross, star or triangle) and numbers (one, two, three or four) of figures (Heaton, Chelune, Talley, Kay, & Curtiss, 1993).

Planning

Zoo test and *Key test* are part of the Behavioural Assessment of Dysexecutive Syndrome (Wilson, Alderman, Burgess, Emslie, & Evans, 1996).

One Touch Stockings of Cambridge assesses spatial planning and working memory based upon the Tower of Hanoi test. The participant is shown two displays containing three coloured balls. Dependent variables are problems solved on first choice, mean choices to correct, mean latency to first choice and mean latency to correct (Cambridge Cognition Ltd, 2012).

Decision making

Cambridge Gambling Task measures decision-making and risk-taking behaviour. It has been presented a row of ten boxes across the top of the screen, some red and some blue. Rectangles containing the words 'red' and 'blue' can be seen at the bottom of the screen. Participants then have to decide whether the yellow taken is hidden in a red box or in a blue box. A set of points to gamble with is shown on the screen, which are displayed in rising or falling order. Participants are allowed to place whatever bet they want with the number of points provided in order to gamble on their confidence in this judgement. The participants are aske to earn as many points as possible (Cambridge Cognition Ltd, 2012).

Empathy (table 1)

Eyes Test measures emotion decoding abilities by identifying the emotion that best represents the expression of the eyes in 36 photographs that show the eye region of the face of different men and women. In fact, subjects must choose one of a set of four adjectives. Total score, which ranged from 0 to 36 points, is obtained by summing the number of correct answers (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001), being interpreted a higher score as indicative stronger emotional decoding abilities.

The Spanish version *Interpersonal Reactivity Index* measures empathic response (Mestre, Frías, & Samper, 2004), which includes four subscales such as perspective taking and fantasy (cognitive empathy) and emotional empathic concern and personal distress (emotional empathy). Responses are given on a 5-point Likert scale. The total score ranged from 7 to 35 points in each subscale, and a higher score indicate higher empathic skills.

Alexithymia was assessed using the Spanish version of the Toronto Scale of 20 Elements (TAS-20) by Bagby, Parker & Taylor (1994). It is a scale of 20 Likert type reagents with 6 variation points per element (from 0 to 5).

Table 1. *Neuropsychological test battery.*

Neuropsychological test	
IQ	
Matrix reasoning WAIS-III	Abstract reasoning
Digit symbol-coding and symbol search	Processing speed
Similarities of the WAIS-III	Verbal reasoning
Attention	
d2 test	Sustained attention
Rapid Visual Information Processing (RVP)	Sustained attention
Attention Switching Task (AST)	Switch-attention
Choice Reaction Time (CRT)	Reaction times
Memory	
Word List WAIS-III	Immediate recall, delayed recall and recognition.
Rey–Osterrieth Complex Figure Test	Visuospatial constructional ability and visual memory
Logical Memory WMS-III	Short and long-term memory and recognition
Digit Span WAIS-III	Short-term memory, attention, and concentration
Letter-Number Sequencing WAIS-III	Simultaneously recall and organize stimuli (working memory)
Spatial Span WMS-III	Working memory capacity (visuospatial)
Spatial Span Test (CANTAB)	Working memory capacity (visuospatial)
Executive functions	
Semantic categorial evocation of animals and FAS verbal phonemic fluency	Verbal fluency
Stroop	Divided attention and resistance to interference
Hayling test	Verbal inhibition
Five-Point test	Design fluency
Wisconsin Card Sorting Test (WCST)	Abstract reasoning and the ability to change cognitive strategies in response to environmental changes (cognitive flexibility)
Zoo test and Key test	Ability to plan a strategy to solve a problema (planning)
One Touch Stockings of Cambridge (OTS)	Spatial planning and working memory
Cambridge Gambling Task (CGT)	Decision-making and risk-taking behaviour
Empathy	
Reading the mind in the eyes	Emotion decoding abilities

Data analysis

The Shapiro-Wilk test was used for exploring whether the data were normally distributed. Due to the fact that the majority of variables did not meet the assumption of normality ($p < .05$), therefore, it was decided to carry out nonparametric tests for statistical analysis of the results. U Mann–Whitney test was used to check for significant differences between the groups in socio-demographic, questionnaire scores and neuropsychological test. In addition, chi square analyses were performed for categorical variables such as socio-demographic characteristics (nationality, marital status, level of education, employment status, etc.).

Data analyses were carried out using IBM SPSS Statistics for Windows, Version 22.0 (Armonk, NY, USA). P values < 0.05 were considered statistically significant. Average values are reported in tables as mean±SD.

Results

Sample characteristics

Descriptive characteristics for LTAA and controls are presented in Table 2. Regarding AVEX (85% sample) and AA patients (15% sample) there were not differences between clinical and socio-demographic characteristics. Groups did not differ in anthropometric or socio-demographic variables, personal history of traumatic brain injury, or temporary loss of consciousness. Nevertheless, they differed in self-reported executive dysfunction, (Mann–Whitney $U = -2.64$, $p = 0.008$), and apathy, (Mann–Whitney $U = -2.80$, $p = 0.005$), with LTAA obtaining higher scores than controls. Moreover, a significant effect for group was found in IQ matrix Reasoning, (Mann–Whitney $U = -3.42$, $p = 0.001$), IQ similarities, (Mann–Whitney $U = -3.42$, $p = 0.001$), and IQ copy (Mann–Whitney $U = -3.03$, $p = 0.002$), having LTAA higher scores in all these scales than controls.

Table 2. *Mean ± SD of descriptive characteristics for all groups (*p < .05).*

		Alcohol group (n = 40)	Controls (n = 39)
Age (years)		45.55±8.99	42.05±11.33
BMI (Kg/m²)		27.74±3.42	26.90±4.96
Nationality			
Spanish		34 (85%)	32 (82%)
Latin Americans		6 (15%)	7 (18%)
Marital status			
Single		15 (38%)	17 (44%)
Married		9 (23%)	9 (23%)
Separate/Divorced/Widowed		16 (40%)	10 (26%)
Number of children		.94±1.03	1.20±0.95
Level of education			
Primary/lower secondary		18 (45%)	18 (46%)
Upper secondary/vocational training		17 (43%)	17 (44%)
University		5 (12%)	4 (10%)
Employment status			
Employed		18 (45%)	18 (46%)
Unemployed		22 (55%)	21 (54%)
Income level			
1800€ – 12000€		25 (63%)	25 (64%)
12000€ – 30000€		12 (30%)	12 (31%)
> 30000€ – 90000€		3 (7%)	2 (5%)
Personal history of traumatic brain injury			
Yes		13 (48.14%)	14 (40%)
No		14 (51.85%)	21 (60%)
Temporary loss of consciousness			
Yes		8 (29.36%)	14 (40%)
No		19 (70.37%)	21 (60%)
Alcohol Use Variables			
Age started drinking		17.74±8.82	-
Age at first heavy use		22.75±7.92	-
Average lifetime drinking dose (gr/day)		202.84±148.69	
Duration of active drinking (years)		22.80±8.82	-
Time of alcohol abstinence (months)		40.72±77.40	-
Family members with AUD	Yes	37%	-
	No	63%	-
Cigarettes/day*		16.61±10.13	9.75±7.21
Fagerstrom test		4.84±3.91	3.17±1.11
Frontal Behavior test			
Executive dysfunction**		19.77±9.54	13.14±7.14
Apathy**		10.33±5.77	6.25±4.94
Desinhibition		9.33±4.47	7.05±3.51

Neuropsychological assessment Attention and memory (table 3)

Attention

We checked group differences and observed a number of differences that approached significance in the D2 Test, especially the total number of characters processed (Mann–Whitney U = -3.42, p = 0.001), total correctly processed (Mann–Whitney U = -2.97, p = 0.003), total number of errors (Mann–Whitney U = -2.83, p = 0.005), total performance (Mann–Whitney U = -3.42, p = 0.001) and concentration performance (Mann–Whitney U = -3.37, p = 0.001), while LTAA had a lower number total number of characters processed and total correctly processed, worse D2 and concentration performance and made more errors than controls. Regarding RVP, a significant group effect was found (Mann–Whitney U = -2.32, p = 0.021), LTAA performing less well in detecting the target sequences than controls.

Memory

Regarding the Wechsler Memory Scale-III Word List subscale, the difference between groups for the total number of words remembered (Mann–Whitney U = -4.19, p > 0.001), the number of words remembered in the first trial (Mann–Whitney U = --3.19, p = 0.001), short-term memory (Mann–Whitney U = -2.32, p = 0.020), the interference list (Mann–Whitney U = -4.19, p > 0.001) and recognition (Mann–Whitney U = -2.74, p = 0.006) were significant. LTAA remembered and recognized fewer words than controls.

For the ROCF test, “group” proved to be significant for copy time (Mann–Whitney U = -3.12, p = 0.002), short-term memory score (Mann–Whitney U = -3.17, p = 0.001), and long-term memory score (Mann–Whitney U = -3.48, p = 0.001), with LTAA needing more time to copy the figure and remembering the figure less well (both short-term and long-term) than controls.

Regarding the Logical Memory subscale, a significant effect of group was found in the first time that text A was read (Mann–Whitney U = -2.85, p = 0.004), text A units (Mann–Whitney U = -2.93, p = 0.003), and text B units 1, (Mann–Whitney U = -2.57, p = 0.010), and topics 1 (Mann– Whitney U = -2.12, p = 0.034) and text B units 2, (Mann– Whitney U = -2.05, p = 0.040), and topics 2 (Mann–Whitney U = -2.07, p = 0.039), LTAA remembered fewer units and topics than controls. Therefore, there were also group effects for delayed recalled of text A units (Mann–Whitney U = -2.06, p = 0.039) and topics, (Mann–Whitney U = -2.87, p = 0.004) and text B units (Mann–Whitney U = -1.97, p = 0.004), LTAA obtaining worse scores, meaning that they remembered both texts less well, than controls. There were also group effects for the recognition task (Mann–Whitney U = -3.72, p < 0.001), the LTAA group having lower scores than controls.

In the Digits Span subscale, though no significant differences were found between groups in direct scores, “group” was found to be significant in inverse order (Mann–Whitney U = -3.83, p < 0.001), LTAA remembering fewer digits, especially in inverse order, than controls. Similarly, regarding the Letter-Number Sequencing subscale, there was a “group” effect (Mann–Whitney U = -3.83, p < 0.001), with LTAA remembering fewer letters and numbers than controls.

Table 3. *Mean ±SD of Memory tests of all grups (*p < .05).*

	Alcohol group (n = 40)	Controls (N = 39)
IQ		
Speed processing		
Symbol search	30.05±8.89	33.98±9.35
Abstract reasoning		
Digit Symbol - Coding		
Coding**	60.72±14.31	70.58±14.08
Incidental Learning Pairing*	10.21±5.39	12.50±4.96
Incidental Learning Free Recall	6.41±2.55	7.40±1.46
Copy**	103.51±23.16	117.40±18.76
Matrix Reasoning***	11.74±4.51	16.55±6.49
Similarities*	16.33±4.52	18.73±4.33
Attention		
D2		
TR***	387.18±95.94	485.70±79.37
O	23.92±22.64	30.55±31.00
C**	17.87±31.53	8.93±18.80
TA**	136.97±39.72	165.78±41.07
TOT= TR - (0 + C)***	345.38±88.85	419.23±88.37
CON= TA –C***	119.10±42.93	156.85±51.49
E%= (100(O+C))/TR	10.78±7.68	8.80±9.99
AST		
Switch cost	-146.33±136.41	-142.44±116.85
Percentage of correct responses (%)	89.31±11.24	93.03±6.73
Congruency cost	115.25±119.01	92.17±81.56
RVP Sensitivity (from .0 to 1.00)*	0.89±0.05	0.91±0.08

CRT		
Percentage of correct answers (%)	99.15±1.05	99.32±0.91
Mean correct latency (ms)	424.15±81.47	411.20±93.76
Memory		
Word Lists test		
Total words recalled***	28.91±5.38	34.64±4.99
Short-term memory*	7.51±2.00	8.36±1.94
Long-term memory*	6.76±2.14	7.72±2.16
First trial***	4.92±1.49	6.00±1.37
Learning curve	3.75±1.92	4.54±1.57
Interference list***	3.73±1.61	5.28±1.67
Omission	1.78±1.64	2.31±1.49
Recognition**	22.43±1.21	22.97±1.55
Rey Figure		
Copy score	34.86±1.39	35.31±1.23
Copy time**	152.24±59.70	118.93±44.86
Short-term memory score***	19.92±7.25	25.10±6.01
Short-term memory time	119.54±43.19	110.08±45.23
Long-term memory score***	19.19±6.21	24.46±6.38
Long-term memory time	95.77±33.82	93.46±32.57
Logical Memory test		
Immediate recall:		
Total score on the first try**	22.65±7.85	27.23±6.85
Text A		
Units**	11.93±3.45	14.15±3.84
Topics	4.60±1.99	5.41±1.27
Texts B		
Units 1*	10.45±4.53	13.08±3.72
Topics 1*	4.45±2.36	5.72±1.10
Units 2*	10.45±4.53	10.45±4.53
Topics 2*	4.45±2.36	4.45±2.36
Delayed recall:		
Text A		
Units*	9.00±4.37	10.87±3.85
Topics**	4.10±2.01	5.38±1.37
Texts B		
Units*	14.45±4.85	16.41±4.93
Topics	5.13±1.91	5.92±1.27
Recognition***	23.70±3.24	25.82±4.93
Digits		
Direct order	8.47±1.61	9.00±2.71
Inverse order***	5.06±1.53	6.90±2.19
Total score**	13.55±2.56	15.90±4.47
Letters and numbers		
Total score***	8.44±2.10	10.85±2.77
Spatial location		
Direct order	8.64±1.76	9.23±1.77
Inverse order**	7.14±1.59	8.38±2.18
Total score*	15.79±2.80	17.62±3.38

With regards to the Spatial Span subscale, "group" proved to be significant in inverse order (Mann–Whitney U = -2.65, $p = 0.008$), and total score (Mann–Whitney U = -2.13, $p = 0.033$), with LTAA being less able to repeat the series of movements made by the evaluator than controls. However, there were no significant differences between groups in direct order Spatial Span score.

Executive functions and empathic skills (table 4)

Cognitive flexibility

A significant "group" effect was found for the following WCST scales: total trials, (Mann–Whitney U = -3.83, $p < 0.001$); correct trials, (Mann–Whitney U = -2.89, $p = 0.004$); total errors, (Mann–Whitney U = -2.82, $p = 0.005$); perseverative errors, (Mann–Whitney U = -3.29, $p = 0.001$); rate of perseverative errors, (Mann–Whitney U = -2.61, $p = 0.009$); non-perseverative errors, (Mann–Whitney U = -2.34, $p = 0.019$); completed categories, (Mann–Whitney U = -3.02, $p = 0.003$), and failures to maintain the set, (Mann–Whitney U = -3.54, $p < 0.001$). LTAA needed more trials, made more errors, completed fewer categories, and more often failed to maintain the set than controls (Table 4).

Planning

Regarding the Zoo test, group proved to be significant in execution time (Mann–Whitney U = -2.27, $p = 0.023$), and execution time of version 2 (Mann–Whitney U = --2.92, $p = 0.008$), with LTAA spending more time planning than controls, which means that they had more problems developing logical strategies than controls.

There was a significant group effect for the total score on the Key test (Mann–Whitney U = -4.65, $p < 0.001$), LTAA being less able to plan a strategy to solve a problem than controls. Nevertheless, no significant differences were found between groups in planning and execution time.

A significant "group" effect was found in the OTS problems solved on the first choice (Mann–Whitney U = -3.84, $p < 0.001$), and in mean choices to correct total (Mann– Whitney U = -3.70, $p < 0.001$), third (Mann–Whitney U = -3.11, $p = 0.002$), fourth (Mann–Whitney U = -3.44, $p = 0.001$), fifth (Mann–Whitney U = -2.30, $p = 0.022$) and sixth (Mann–Whitney U

= -3.77, p < 0.001) movements to correct, LTAA requiring more movements to finish the exercises and achieving less good performance than controls. Nonetheless, there were no significant differences in trials which only required one or two movements. Finally, a group effect was also found for latency to first choice (1 move) (Mann–Whitney U = -3.61, p < 0.001), (2 moves) (Mann–Whitney U = -2.52, p = 0.012) and latency to finish exercises correctly in exercises that need one movement (Mann–Whitney U = -3.84, p < 0.001), 2 moves (Mann– Whitney U = -2.35, p = 0.019), and 4 moves (Mann–Whitney U = -2.08, p = 0.038). Specifically, LTAA took more time to do the movements than controls.

Decision making

Regarding the CGT, no significant differences were found between groups in the proportion bets (Mann–Whitney U = -.13, p = 0.895), delay aversion (Mann–Whitney U = -1.26, p = 0.208), deliberation time (Mann–Whitney U = -.71, p = 0.474), quality of decision making (Mann–Whitney U = -.11, p = 0.914), risk adjustment (Mann–Whitney U = -.95, p = 0. 344) and risk taking (Mann–Whitney U = -.05, p = 0.953).

Empathy

A significant group effect was found in the IRI Personal distress (Mann–Whitney U = -4.29, p < 0.001), with LTAA presenting higher scores than controls. Nonetheless, groups did not differ in fantasy, empathic concern or perspective taking. With regards to the TAS, group proved to be significant (Mann–Whitney U = -2.94, p = 0.003), LTAA obtaining higher scores than controls. Finally, there were not found differences between groups in eye test.

The calculated type II error ranged from 1% to 12% in all the analysis.

Table 4. *Mean ±SD of executive functions and empathy tests scores for all groups (*p < .05).*

	HA (n = 40)	**LA (n = 39)**
Verbal fluency		
Semantic (animals)	21.64±5.62	23.85±4.68
Phonemic (F, A and S)	37.33±12.11	40.38±13.82
Design fluency		
Part A***	15.26±5.15	19.38±5.53
Part B*	16.97±5.10	10.30±5.16
Inhibition		
Stroop 1*	100.23±14.34	108.38±14.52

Stroop 2	70.23±11.07	72.00±11.95
Stroop interference*	39.33±8.47	44.03±11.24
Hayling part A		
Time (sec)*	1.87±1.06	1.43±0.84
Score**	14.00±0.93	14.37±0.95
Hayling part B		
Time (sec)	4.65±3.82	3.83±3.09
Score	13.97±8.05	11.90±8.15
Cognitive flexibility		
Total trials***	113.32±19.41	93.40±21.17
Correct trials*	74.11±12.61	67.45±9.68
Total errors*	39.21±22.14	26.35±21.64
Perseverative mistakes*	21.71±13.07	13.90±13.57
Non perseverative mistakes*	17.39±11.79	11.87±10.22
Random not perseverative errors*	24.18±19.46	15.97±16.58
Completed categories*	4.34±1.79	5.33±1.56
Attempts to complete the first category	21.32±22.70	16.02±19.02
Failure to maintain the set**	1.37±1.65	0.40±0.95
Planning		
Zoo version 1		
Planning time (sec)	72.32±45.88	61.27±26.50
Execution time (sec)*	71.56±33.59	56.40±33.84
Errors	1.41±1.74	1.13±1.20
Total score version 1	3.15±3.45	3.97±2.81
Zoo version 2		
Planning time (sec)	32.51±19.03	23.19±12.72
Execution time (sec)*	45.23±20.14	35.37±18.66
Errors	0.59±0.97	0.36±0.67
Total score version 2	6.26±2.11	7.03±1.97
TOTAL SCORE	9.49±4.80	11.00±3.80
Key Test		
Planning time (sec)	20.76±29.39	14.94±14.53
Execution time (sec)	36.51±36.23	32.64±26.18
Total score***	6.79±3.51	11.21±3.58
OTS		
Problems solved on first choice* **	15.03±3.02	16.00±4.45
Mean choices to correct* **	1.71±0.53	1.63±0.46
Problems with:		
1 moves	1.17±0.53	1.12±0.22
2 moves	1.25±0.39	1.17±0.42
3 moves**	1.42±0.49	1.37±0.46
4 moves***	1.67±0.58	1.60±0.59
5 moves*	1.97±0.84	1.79±0.73
6 move***	2.79±1.15	2.72±1.08
Mean latency to first choice	14673.62±7265.36	18906.10±11429.33
Problems with:		
1 moves***	8747.65±3302.95	12087.74±9363.30
2 moves*	7082.91±22705.63	7825.22±23041.18
3 moves	8965.16±4337.98	10427.44±4870.10
4 moves	14439.84±11311.03	16357.72±9071.56
5 moves	24721.74±16877.17	26256.96±18742.32
6 move	24084.41±17827.82	40481.52+48533.45

Mean latency to correct		
Problems with:		
1 moves***	9313.49±3694.57	14111.03±11395.22
2 moves*	8902.96±3818.69	10136.43±7401.45
3 moves*	11758.40±8527.88	13884.02±8386.89
4 moves*	22097.44±24259.04	22477.01±13627.41
5 moves	35255.63±25785.04	35885.43±23406.45
6 moves	39906.75±28624.96	57317.70±51771.00
CGT		
Delay aversion	.19±.28	.13±.19
Deliberation time	2722.61±893.26	2587.29±801.52
Proportion bet	.50±.13	.51±.18
Quality of decision making	.88±.11	.85±.16
Risk adjustment	.95±.88	.78±.90
Risk taking	.54±.13	.55±.17
Empathy		
IRI		
Perspective taking	22.86±5.87	22.79±4.81
Fantasy	18.59±5.05	19.21±6.67
Empathic concern	25.47±4.17	25.95±3.54
Personal distress***	16.21±4.26	12.00±3.00
Eyes Test		
Total score	23.03±4.50	22.43±4.261
TAS**	63.92±12.93	54.89±11.60

Discussion

In the present study, we compared the neuropsychological performance on a computerized battery with pencil-and-paper tests of LTAA with non-alcoholic matched for demographic variables controls. We initially hypothesized that LTAA would manifest more neuropsychological dysfunctions, particularly memory and executive dysfunction, than controls. As expected, the LTAA group presented deficits in the abstract reasoning, speed processing, sustained attention, working and long-term memory (verbal, logical and visuospatial), cognitive flexibility, inhibition and time of planning. In addition, the LTAA had significantly more personal distress and alexithymic symptoms than the controls, though they did not differ from the controls in perspective taking, fantasy, empathic concern and emotional decoding skills.

Our study reinforces that certain cognitive skills such as abstract reasoning, speed processing, sustained attention, working and long-term memory (verbal, logical and visuospatial), cognitive flexibility, inhibition and time of planning might be persistently impaired after long term abstinence (Fein et al., 2006; Stavro et al., 2013). Additionally, LTAA also showed higher self-reported executive dysfunction, apathy, disinhibition and impulsivity in comparison with controls. In fact, it has been suggested that a result of chronic hazardous alcohol use could increase the risk of disinhibition and impulsivity, which entails a lack of concern for the consequences of inappropriate behaviours (Kravitz et al., 2015; Staples & Mandyam, 2016). These alcohol-related disinhibitory behaviors can be traced by neurobiological abnormalities such as prefrontal cortex, which is part of the substrate for executive control (Abernathy, Chandler, & Woodward, 2010).

Based on WCST and OTS performance, LTAA presented less cognitive flexibility and weaker planning skills than controls. This means that they have problems to use negative feedback, suggesting they are less able to learn from aversive experience and modify behaviours in light of this learning. They also had problems developing logical strategies, with their abstract reasoning and they also need more time to planning their decisions and inhibit inappropriate responses than controls. It seems logical to conclude that these deficits could be explained by LTAA sustained attention and working memory impairments', which constrain the ability to learn, remember and adaptively utilize associations, reasoning, and problem solving.

Whether good decision making is a result of an accurate judgment of anticipated outcomes (Clark, et al., 2011), attention and memory complaints may lead to ignorance of possibly advantageous choice alternatives or avoid unnecesary risks in decision-making situations. In fact, speed processing, attention and memory are important for these abilities, allowing focus on relevant stimuli and in inhibiting automatic thinking. Nonetheless, as LTAA did not differ from controls in CGT decision-making, we can't assume that LTAA make risky and/or impulsive decisions. Conversely, a previos research concluded that LTAA exhibited poor decision-making on the Iowa Gambling Task, which was attributed to their tendency to immediate reward than by delayed punishment (Fein et al., 2006). These differences between studies could be attributed to methodological reasons such as the neuropsychological tests employed in each study and/or by heterogeneity of AUD samples (time of abstinence, number of years of alcohol consumption, *polydrug* abuse, etc). However, it is important to note that in our study other cognitive processes requiring switch-attention, reaction times, verbal fluency, verbal inhibition, cognitive empathy and emotional decoding abilities seem well preserved. As the somatic marker model proposes that decision-making depends on cognitive and emotional processes (Gutnik, Hakimzada, Yoskowitz, & Patel, 2006), the relatively well preserved cognitive and emotional abilities may help LTAA avoid unnecessary risks, but our data demonstrated that LTAA need more time to plan o make a choice than non-alcoholic controls. Therefore, our results underscoring the view that cognitive flexibility, inhibition or planning impairments are the main and determinant cause of decision-making deficits.

Several studies have been reported persistent deficits for processes related to social cognitive information, decoding of affective states, empathic ability, and in theory- of-mind in individuals with prolonged alcohol abstinence (Grynberg, Maurage, & Nandrino, 2017; Maurage, Pesenti, Philippot, Joassin, & Campanella, 2009; Stasiewicz et al., 2012). Additionally, sober alcohol patients tend to present difficulties to identify, differentiate, and express feelings (alexithymic symptoms) (Stasiewicz et al., 2012). Our results partially reinforced previous research in this field. Indeed, LTAA exhibited higher self-reported personal distress and alexithymic symptoms in comparison with controls. Conversely, they did not showed differences in cognitive empathy and emotional decoding abilities in comparison with controls. Based on or data, we could conclude that specific empathic measures did not present deficits after long-term abstinence, with the notable exception of personal distress and alexhitimia, on which alcoholism-related deficits remained. As regulate distressing emotional experiences and interpersonal difficulties to identify, differentiate, and express feelings has been associated with relapse after detoxification (Zywiak, Westerberg Connors, & Maisto 2003), this suggest the importance to consider emotional and interpersonal difficulties in clinical treatment for alcoholics.

The main limitation of the study is that the sample sizes were modest. For this reason, the findings should be considered preliminary, and further research is needed to explore these patterns in larger samples. Another limitation of the current study is the use of cross-sectional data rather than longitudinal data, and hence definitive conclusions cannot be drawn regarding the long-term effects of alcohol in these cognitive skills. Moreover, it would be possible that alcoholics present pre-existent cognitive deficits to alcohol consumption, which increase their proneness to alcohol abuse. Hence, we can not demonstrate cognitive recovery or impairments over time. Longitudinal studies are necessary to understand how duration of alcohol abstinence could contribute to scope and limitations of recovery of emotional and social abilities. Additionally, it would be necessary to specify the role of these cognitive deficits in alcohol-relapse. Another limitation, the neuropsychological tests employed to assess these deficits tend to measure broad categories of abilities without a homogeneous consensus on which specific attributes define these functions.

Finally, it seems logical that these deficits may interfere in workshops, and psychotherapy in alcoholic patients during the detoxification period. Indeed, the large amounts of verbal and complex material presented in therapy programs is not being adequately processed due to conceptual thinking and abstract reasoning impairments in alcoholics. Nevertheless, it should be mentioned that the absence of recording therapeutic advice or low participation in workshops might also reflects participants' non-engagement with the program and not necessarily cognitive deficits. It may be necessary to develop early coadjuvant neuropsychological rehabilitation program to existent psychotherapy programs after detoxification (Teixidor López, Frías-Torres, Moreno-España, Ortega, Barrio, & Gual, 2017). Hence, this knowledge could be employed to guide the development of early coadjuvant treatments, which allows to improve the affected cognitive domains and in turn reduce the rate of alcohol recidivism.

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Chapter 5

Study 4. Does alcohol abuse drive intimate partner violence perpetrators' psychophysiological response to acute stress?

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Introduction

Scientifically strong evidence has shown that autonomic nervous system (ANS) functioning can be employed as a classification criteria in violent men as perpetrators of proactive and reactive violence present a differential pattern of autonomic dysregulation (Babcock, Green, Webb, & Yerington, 2005; Hansen, Johnsen, Thornton, Waage, & Thayer, 2007; Lorber, 2004; Patrick, 2008; Romero-Martínez, Lila, Williams, González-Bono, & Moya-Albiol, 2013a; Romero-Martínez, Nunes-Costa, Lila, González-Bono, & Moya-Albiol, 2014; Scarpa, Tanaka, & Chiara-Haden, 2008; Vries-Bouw et al., 2011; Williams et al., 2015). Nevertheless, it is not clear whether resting values of ANS measures accurately reflect proneness to violence. Therefore, it would be advisable to consider resting values as well as ANS reactivity to stress and/or concrete stimuli to characterize the profile of generally violent individuals.

Regarding intimate partner violence (IPV), Gottman, Jacobson, Rushe, & Shortt, (1995) proposed two different IPV perpetrator categories based on batterers' psychophysiological reactivity to an acute laboratory stressor (marital conflict). These batterers were classified as Type I if they showed heart rate (HR) hypoactivity to confront this type of stressor. In fact, Gottman et al. (1995) interpreted this profile as psychopathic because they presented proactive violence, being more severely violent than the other batterers. Furthermore, this kind of IPV perpetrator tends to employ manipulative strategies to control their wives. On the other hand, IPV perpetrators were classified as Type II if they presented an HR hyperreactivity to stress. Additionally, they scored higher in dependent personality traits and they usually employed impulsive/reactive violence. Nevertheless, two later studies by Babcock, Green, Webb, & Graham (2004) and Meehan, Holtzworth-Munroe, & Herron (2001) failed to replicate this classification. Although both studies employed similar methodologies (HR and psychological measurements and a laboratory stressor) to Gottman et al. (1995), authors attributed their failure to replicate earlier findings to a methodological weakness in the initial study having interfered in the HR reactivity calculation. Specifically, Gottman et al. (1995) measured HR resting values over a very short period of time, while the later studies used longer resting times in order to increase the reliability of the measurement and more accurately adjust for baseline in their analysis of the psychophysiological response to stress. Notably, the later studies did not find any significant differences in resting values or reactivity to stress between the two groups of IPV perpetrators.

Studies by Romero-Martínez et al. (2013a, 2014) have attempted to build on the results of Gottman et al. (1995) employing several cardiovascular and electrodermal markers not employed in previous studies in this field of research. Specifically, they compared the ANS response to a modified version of the Trier Social Stress Test (TSST) in IPV perpetrators described as reactive, based on their criminal record and psychological characteristics, and non-violent men. In the procedure, participants had to make a speech about their own experiences and problems with IPV and give their opinion regarding Spanish legislation, followed by a mental arithmetic test. In this work, IPV perpetrators showed an increase in skin conductance level (hyperreactivity) when they prepared to confront the stress after researchers had presented the instructions for the task (preparatory period), this hyperreactivity being associated with impulsivity traits. In addition, they had higher HRs, lower vagal ratios and higher non-specific skin conductance responses (NSCRs) after the stressor ended (recovery period) than controls. Finally, they showed shorter PEP (higher sympathetic predominance) than controls throughout the assessment.

The sympathetic predominance observed may be indicative of an ANS dysregulation. In this regard, individuals with this psychophysiological profile maintain high levels of vigilance (or activation), irritability and tension (negative affect) over sustained periods of time, reducing the threshold to violent behavior when exposed to certain types of stimuli that are incongruent with their hostile cognitive schemas like, for example, sexist ideas about women or dominant roles in relationships (Dawson, Schell, & Filion, 2000). Additionally, the facilitation of violence might also be explained by IPV perpetrators' cognitive processing deficits which may include low processing speed, and poor attention switching and sustained attention, as well as deficits in working memory and others associated with executive dysfunctions such as poor cognitive flexibility, planning abilities and inhibitory control (Romero-Martínez & Moya-Albiol, 2013; Romero-Martínez, Lila, & Moya-Albiol, 2016;

Romero-Martínez, Lila, & Moya-Albiol, in press; Vitoria-Estruch et al., 2017; Vitoria-Estruch, Romero-Martínez, Lila, & Moya-Albiol, in press).

Gottman et al. (1995) and later studies (Babcock et al., 2004; Meehan et al., 2001) neglected the role of chronic alcohol abuse in the development of cognitive impairments (Duke, Giancola, Morris, Holt, & Gunn, 2011; Eckhardt, Parrott, & Sprunger, 2015; Romero-Martínez, Lila, Catalá-Miñana, Williams, & Moya-Albiol, 2013b; Romero-Martínez, Lila, & Moya-Albiol, 2015; Romero-Martínez, Lila, Martínez, Pedrón-Rico, & Moya-Albiol, 2016; Vitoria-Estruch et al., 2017; in press; Romero-Martínez, Lila, & Moya-Albiol, 2017) and ANS dysregulations (Boschloo et al., 2011; Crouch et al., 2015; Karpyak, Romanowicz, Schmidt, Lewis, & Bostwick, 2014) in this kind of population and the sense in which this dysregulation entails an abnormal stress response. In fact, it has been suggested that chronic alcohol consumption tends to depress the central nervous system suppressing excitatory nerve pathway activity in the resting state (Mukherjee, 2013), but there are inconsistencies concerning whether alcohol tends to reduce sympathetic or parasympathetic control of the ANS (Chida et al., 1994; Chida, Takasu, & Kawamura, 1998; Monforte et al., 1995; Reed, Porges, & Newlin, 1999; Porges, 2001; Villalta, Estruch, Antúnez, Valls, & Urbano-Márquez, 1989). Thus, it makes sense to study how alcohol disrupts IPV perpetrators response to stress.

The present study sought to confirm and extend the results of Romero-Martínez et al. (2013a, 2014), while including some changes in the experimental procedure and increasing the sample size, to improve our understanding of the complex phenomenon of IPV. Specifically, the first objective of this study was to analyze reactive IPV perpetrators' psychological (trait and state) and physiological response to a set of cognitive tests, namely, an acute laboratory stressor previously shown to produce psychophysiological activation (Romero-Martínez & Moya-Albiol, 2017a; 2017b), compared to that of a non-violent group (controls). Based on the results of Romero-Martínez et al. (2013a, 2014), we expected that reactive IPV perpetrators would present higher sympathetic predominance and lower vagal regulation in response to acute stress than controls. Moreover, an additional group of IPV perpetrators with high-risk alcohol use was included to compare their ANS response with that of the low-risk alcohol use IPV perpetrators and the non-violent group. As chronic heavy alcohol consumption has a depressive effect on ANS activity and is associated with higher levels of impulsivity trait (Chida et al., 1994; Chida, Takasu, & Kawamura, 1998; Monforte et al., 1995; Reed, Porges, & Newlin, 1999; Villalta, Estruch, Antúnez, Valls, & Urbano-Márquez, 1989), we hypothesized that IPV perpetrators who were heavy drinkers would, due to the effect of alcohol, show lower sympathetic predominance and higher vagal regulation in response to stress than IPV perpetrators with low alcohol consumption. This type of research seeks to help us improve our understanding of emotional and psychophysiological dysregulation in IPV perpetrators, which may underlie their predisposition to violence.

Methods

Participants

The final sample was composed of 95 men who participated voluntarily in the study: 27 IPV perpetrators who were heavy drinkers (see definition below), 33 IPV perpetrators who were not heavy drinkers and 35 non-violent men with no history of violence, as the control group. The IPV perpetrators were recruited from the community psychological and psychoeducational treatment program, *CONTEXTO*, carried out in the Department of Social Psychology of the University of Valencia (Spain). This is a court-mandated program for men sentenced to less than 2 years in prison for violence against women in intimate relationships who had no previous criminal record, and therefore, received a suspended sentence on condition that they attend this intervention program (Lila, Gracia, & Herrero, 2012; Lila, Oliver, Catalá-Miñana, & Conchell, 2014; Lila, Oliver, Galiana, & Gracia, 2013).

Initial inclusion criteria for IPV perpetrators were: having being sentenced to prison for IPV; not having been convicted for assault outside the home; and not being diagnosed with any mental illness. Candidates continued to be eligible to participate if the qualitative interviews and SCL-90-R scores confirmed they were free of mental illness. We then included IPV perpetrators that reported an alcohol intake of 30 g/day or more (Cao, Willett, Rimm, Stampfer, & Giovannucci, 2015; Cho, Lee, Rimm, Fuchs, & Giovannucci, 2012;

Scoccianti et al., 2016) and had four or more symptoms of Alcohol Use Disorder (AUD) listed in the DSM-5 (American Psychiatric Association, 2013), these forming the group of high alcohol users (HAs), and those that reported an intake of less than 30 g/day and had less than two DSM-5 symptoms of AUD, classified as low alcohol users (LAs), while other IPV perpetrators were excluded.

Controls were recruited by mailings and advertisements. Inclusion criteria were: having similar socio-demographic characteristics to the experimental groups, alcohol consumption lower than 30 g/day and less than two DSM-5 symptoms of AUD, as well as a criminal record certificate attesting to the fact that they had no history of violence.

All participants were right-handed and healthy, lived in Valencia (Spain), were properly informed about the research protocol and gave written informed consent. The research was conducted taking into account current ethical and legal guidelines on the protection of personal data and research with human beings in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of the University of Valencia (H1348835571691).

Procedure

All participants attended three consecutive sessions at the Faculty of Psychology of the University of Valencia. In the first session, participants were interviewed to exclude those with organic diseases and socio-demographic data were collected through a semi-structured interview. Then, participants were asked about their consumption of alcohol and tobacco. Subsequently, they completed an inventory based on DSM-5 to check for the presence of AUD, and the Fragerström Test of Nicotine Dependence to assess addiction level.

In the second session, participants carried out the laboratory cognitive task which consists of a set of neuropsychological traditional tests and the computer-based Cambridge Neuropsychological Test Automated Battery (CANTAB). During the entire session, which lasted approximately 60 minutes, electrodermal activity and cardiorespiratory system activity were continuously recorded with the Vrije Universiteit Ambulatory Monitoring System (VU-AMS) using the corresponding Data Analysis and Management Software (DAMS). For later analyses, the recordings were divided into four periods: resting, preparatory, task and recovery. In each period, the following were measured: skin conductance level (SCL), HR, respiratory rate (RR), pre-ejection period (PEP), the high frequency component (HF) of heart rate variability and respiratory sinus arrhythmia (RSA). In addition, pre- and post-session assessments were carried out using the Positive and Negative Affect Schedule (PANAS).

In the third session, a battery of psychological trait variables was assessed using the Frontal Systems Behavior Scale (FrSBe) and Plutchik's Impulsivity Scale. At the end of this session participants were paid €50 for their participation.

Electrodermal and cardiorespiratory recording

The VU-AMS used for recording physiological data requires seven electrodes. As recommended by the developers of the system, we used a Kendall ARBO H98SG single use electrocardiography (ECG) electrode with Wet Gel for the impedance cardiography and ECG, and the Biopac TSD203 combined with isotonic electrode gel (GEL101) for skin conductance, which was recorded from the medial phalanges of the index and middle or ring finger. A blue lead wire connector with seven lead wires and a yellow connector are used for the recording of the ECG and SCL respectively. An infrared interface cable connects the ambulatory recording device (VU-AMS*5fs*) to the monitoring computer. For memory, we used a 4-GB Ultra Compact Flash external memory card from SanDisk (SDCFHS-004G-G46) and a compact flash card reader to extract the VU-AMS data from the Compact Flash card. Lastly, the Data Analysis and Management Software (DAMS) are used for the VU-AMS device configuration and data manipulation.

The markers used to assess the ANS activity were SCL, habitually used as the main marker of emotional arousal, HR in beats per minute (bpm) and RR in breaths per minute (breath/pm) as two general physiological activation markers, PEP index of contractility measured in milliseconds (msec) as a marker of sympathetic activity, and finally, two markers of parasympathetic activity, namely, the HF power as a component of the heart rate variability signal (equivalent to the 0.15-0.40 Hz band) and the RSA value measured in milliseconds (msec) (De Greus, Willemsen, Klaver, & Van Doornen, 1995; Reyes del Paso, Langewitz, Mulder, Van Roon, & Duschek, 2013; Task Force, 1996; William, et al., 1980).

Psychological measures

Positive and Negative Affect Schedule (PANAS): this is a self-report questionnaire composed of two scales: positive and negative affect. Each subscale is composed of 10 items that participants are asked to answer considering how they feel at the time of the assessment. Items are rated on a Likert scale from 1 (not at all) to 5 (very much) (Watson, Clark, & Tellegen, 1988; Sandín, et al., 1999).

Frontal Systems Behavior Scale (FrSBe): this is a 46-item behavior rating scale that was developed as a measure of behavior associated with damage to the frontal system of the brain. Index scores assess executive dysfunction, disinhibition/emotional dysregulation, and apathy. Participants rated their behaviors on a 5-point Likert-type scale. In this study, we used the Spanish version of the FrSEe (Grace & Malloy, 2001; Caracuel et al., 2012).

Plutchik's Impulsivity Scale: impulsivity traits were assessed using the Spanish version of Plutchik's Impulsivity Scale (Plutchik &Van Praag, 1989; Alcázar-Córcoles, Verdejo, & Bouso-Sáiz, 2015). This scale is composed of 15 items rated on a Likert-type scale with 4 response options (never, sometimes, often, and almost always), scored from 0 to 3 (respectively). It is possible to calculate fours subscales: self-control, planning, physiological behavior control and spontaneous attitudes.

Data analysis

The normality of the data distribution was explored using the Shapiro-Wilk test. After confirming normality of the data, analysis of variance (ANOVA) was carried out to detect significant differences between groups in age, body mass index, number of children, age of starting alcohol consumption, abstinence time, nicotine consumption, nicotine dependence, criminal record for reasons other than IPV, length of sentence, personal satisfaction, internal and external locus of control, participant's cooperation, frustration tolerance and questionnaire scores. In addition, chi-square tests were performed for categorical variables such as socio-demographic characteristics (nationality, marital status, level of education, employment status, etc.).

To examine group effects in psychological and physiological variables, repeated-measures ANOVA was conducted with ‘period’ as the within-participant factor (at two time points in the case of psychological variables: pre-session and post-session; and at four time points for the physiological variables: resting, preparatory, task and recovery) and ‘group’ as the between-participant factor. The Greenhouse-Geisser correction for degrees of freedom was applied where appropriate. For significant results, partial eta-squared was reported as a measure of effect size (η_p^2).

The areas under the curve with respect to the increase (AUCi) and ground (AUCg) were calculated using the trapezoidal formula (Pruessner, Kirschbaum, Meinlschmid, & Hellhammer, 2003; Hellhammer et al., 2007) to analyze the magnitude of responses to the task in electrodermal and cardiorespiratory variables. The AUCi was calculated with reference to the resting value, ignoring the distance from zero for all measurements and emphasizing changes over time, while the AUCg is the total area under the curve of all measurements and assesses the distance of these measurements from ground. Univariate ANOVA was used to examine group effects in AUCi and AUCg, and the Bonferroni post hoc test was then employed to determine the direction of the differences between the groups.

Data analyses were carried out using IBM SPSS Statistics for Windows, Version 22.0 (Armonk, NY, USA). P values < 0.05 were considered statistically significant. Average values are reported in tables as mean$\pm$SD.

Results

Participants’ characteristics

Groups did not differ in anthropometric or socio-demographic characteristics or drug abuse (see Table 1). Furthermore, no differences were found in psychophysiological parameters measured during the resting period. Nevertheless, there were significant difference in FrSBe-Sp total score, $F(2, 92) = 3.36$, $p = .04$, $\eta^2_p = .086$, executive dysfunction, $F(2, 92) = 4.53$, $p = .014$, $\eta^2_p = .086$, and disinhibition, $F(2, 92) = 4.64$, $p = .012$, $\eta^2_p = .086$, with IPV perpetrators (both groups) obtaining higher scores than controls (p

< .05 in both cases). Moreover, there were differences in impulsivity (physiological behavior control), $F(2, 92) = 3.89$, $p = .024$, $\eta^2_p = .086$, and impulsivity (planning skills), $F(2, 92) = 15.96$, $p < .001$, $\eta^2_p = .241$, with both groups of IPV perpetrators scoring lower in physiological behavior control and planning skills than controls ($p < .05$).

Table 1. *Mean ± SD of descriptive characteristics for all groups (*p < .05).*

	IPV perpetrators		Control (N = 35)
	High alcohol (N = 27)	Low alcohol (N = 33)	
Age (years)	40.07±12.10	39.84±10.09	42.14±10.94
BMI (Kg/m²)	22.44±3.80	24.15±3.41	24.46±4.74
Nationality			
Spanish	22 (81.48%)	26 (78.78%)	28 (80%)
Latin Americans	3 (11.11%)	3 (9.09%)	5 (14.26%)
Africans	2 (7.41%)	4 (12.13%)	0 (0%)
Marital status			
Single	10 (37.03%)	11 (33.33%)	16 (45.71%)
Married	5 (18.52%)	9 (27.28%)	14 (40.00%)
Separate/Divorced/Widowed	12 (44.45%)	13 (39.39%)	5 (14.28%)
Number of children	.80±1.30	1.67±2.08	.86±.97
Level of education			
Primary/lower secondary	20 (70.07%)	16 (48.48%)	14 (40%)
Upper secondary/vocational training	6 (22.22%)	15 (45.45%)	18 (51.43%)
University	1 (2.70%)	2 (6.07%)	3 (8.57%)
Employment status			
Employed	12 (44.50%)	14 (43.75%)	15 (42.86%)
Unemployed	15 (55.50%)	19 (59.37%)	20 (57.14%)
Income level			
1800€ – 12000€	14 (51.86%)	13 (39.39%)	21 (60%)
12000€ – 30000€	12 (44.44%)	16 (48.49%)	12 (34.28%)
> 30000€ – 90000€	1 (3.70%)	4 (12.12%)	2 (5.72%)
Age of start alcohol consumption	16.35±2.16	18.10±5.16	17.06±3.02
Amount of alcohol consumption*	64.65±8.32	9.41±11.15	6.23±7.90
Time of alcohol abstinence (months)	0.34±0.79	1.44±3.40	0.69±3.35
Cigarettes/day	11.74±9.04	12.76±10.84	8±6.41
Fagerstrom test	3.94±2.10	4.31±3.59	3.36±2.76
Criminal records different to IPV	28 (84.85%)	21 (84%)	
No	1 (3.03%)	0 (0%)	-
Yes	4 (12.12%)	4 (16%)	-
Yes, but not violence			-
Time of sentencing (months)	9.81±6.52	11.90±8.89	-

Stress responses

Psychological state profiles and appraisal scores

Significant 'period' effects were found for PANAS positive and negative affect, $F(1, 93) = 13.28$, $p < .001$, $\eta_p^2 = .125$ and $F(1, 93) = 9.71$, $p = .002$, $\eta_p^2 = .095$, with all groups showing large decreases in their positive scores and increases in negative scores after the stressor ended (p > .05). Nevertheless, a significant 'period x group' interaction effect was only found for PANAS positive affect, $F(2, 91) = 3.47$, $p = .035$, $\eta_p^2 = .071$, with both groups of IPV perpetrators showing larger decreases than controls, although these differences were not significant.

Regarding appraisal, differences were observed in satisfaction, $F(2, 88) = 16.41$, $p = .005$, $\eta^2_p = .270$, as well as in the internal and external locus of control, $F(2, 88) = 5.64$, $p = .005$, $\eta^2_p = .126$ and $F(2, 88) = 5.64$, $p = .005$, $\eta^2_p = .126$, respectively, with both groups of IPV perpetrators obtaining lower satisfaction scores ($p < .001$ in both cases) and higher external locus of control scores than controls (p < .05 in both cases). Moreover, groups differed in the evaluator's perception of the participant's cooperation, $F(2, 88) = 6.00$, $p = .004$, $\eta^2_p = .125$, and frustration tolerance, $F(2, 88) = 10.10$, $p < .001$, $\eta^2_p = .219$, both groups of IPV perpetrators (HA and LA) obtaining lower scores in cooperation ($p = .006$) and in tolerance to frustration than controls ($p < .001$) (see Table 2).

Table 2. *Mean ± SD of psychological measures for all groups (*p < .05).*

	IPV perpetrators		
	High alcohol (N = 27)	**Low alcohol (N = 33)**	**Control (N = 35)**
PANAS Positive and Negative Affect			
Pre:			
Positive affect*	29.22±8.88	29.61±6.76	28.89±7.45
Negative affect	13.59±3.51	12.70±3.07	12.43±2.33
Post:			
Positive affect*	25.81±9.35	26.03±8.53	28.69±8.01
Negative affect	12.19±2.74	12.06±2.79	11.43±2.52
Appraisal			
Satisfaction*	6.37±1.20	6.57±1.46	8.06±1.11
Internal locus of control*	7.22±1.62	7.19±1.62	8.11±.96
External locus of control*	2.78±1.62	2.81±1.19	1.89±.96
Cooperation*	4±.69	4.17±.65	4.57±.60
Frustration tolerance*	3.05±.86	3.31±.76	3.89±.58

Frontal System Behavior Scale			
Executive dysfunction*	43.42±10.51	36.57±8.11	37.81±7.72
Disinhibition*	41.79±11.96	35.27±9.85	34.34±7.14
Impulsivity Scale			
Self-Control*	5.30±2.90	4.27±2.94	5.88±2.88
Planning*	4.30±2.21	3.2±72	6.52±2.80
Physiological behaviours control*	.63±.92	.79±1.11	1.30±.91
Spontaneous attitude	3.19±1.38	2.82±1.86	3±1.87

Electrodermal and cardiorespiratory responses

The cognitive task carried out in this study was effective to elicit electrodermal and cardiorespiratory responses, as significant effects of 'period' on the SCL, RR, HR, PEP, HF and RSA were found in the total sample: ε = .61, $F(1.82, 168.05) = 22.96$, $p < .001$, $\eta_p^2 = .20$, β = 1; ε = .69, $F(2.08, 191.71) = 85.56$, $p < .001$, $\eta_p^2 = .48$, β = 1; ε = .94, $F(2.82, 265.20) = 5.97$, $p = .001$, $\eta_p^2 = .06$, β = .94; ε = .70, $F(2.09, 197.34) = 110.15$, $p < .001$, $\eta_p^2 = .54$, β = 1; and ε = .77, $F(2.33, 214.43) = 13.76$, $p < .001$, $\eta_p^2 = .13$, β = .99, respectively. Analyzing each group separately, intra-group comparisons revealed significant effects of 'period' in LA IPV perpetrators in SCL, ε = .48, $F(1.44, 37.51) = 12.14$, $p < .001$, $\eta_p^2 = .32$, β = .97; HR, ε = .83, $F(2.50, 65.24) = 24.38$, $p < .001$, $\eta_p^2 = .48$, β = 1; RR, ε = .61, $F(1.83, 264.46) = 3.89$, $p = .029$, $\eta_p^2 = .10$, β = .66; and PEP, ε = .96, $F(2.88, 92.15) = 3.63$, $p = .017$, $\eta_p^2 = .10$, β = .77. Moreover, in HA IPV perpetrators and controls there was a significant 'period' effect in: SCL, ε = .65, $F(1.97, 63.22) = 10.04$, $p < .001$, $\eta_p^2 = .24$, β = .98, and ε = .41, $F(1.23, 42.03) = 4.09$, $p = .041$, $\eta_p^2 = .10$, β = .83, respectively; HR, ε = .59, $F(1.78, 57.24) = 28.78$, $p < .001$, $\eta_p^2 = .47$, β = 1, and ε = .62, $F(1.86, 63.44) = 35.08$, $p = .041$, $\eta_p^2 = .50$, β = 1, respectively; HF, ε = .74, $F(2.22, 71.20) = 25.10$, $p < .001$, $\eta_p^2 = .44$, β = 1, and ε = .77, $F(2.32, 78.88) = 49.65$, $p < .001$, $\eta_p^2 = .59$, β = 1, respectively; and RSA, ε = .88, $F(2.66, 69.32) = 7.28$, $p < .001$, $\eta_p^2 = .21$, β = .96, and ε = .84, $F(2.52, 85.80) = 6.08$, $p = .002$, $\eta_p^2 = .15$, β = .92, respectively. In all groups, SCL, HR and RR increased from resting to the preparatory period and from then to the tasks, afterwards decreasing to recovery. Moreover, in all groups, PEP shortened from resting to the task period and then lengthened to recovery. Conversely, parasympathetic markers (HF and RSA) decreased from resting to the tasks and then increased to recovery.

Differences between groups in electrodermal and cardiorespiratory variables in response to a set of cognitive tests

A significant 'period x group' interaction was found for SCL, $F(4.18, 192.29) = 2.09$, $p = .05$, $\eta_p^2 = .44$, $\beta = .75$, and RR,($F(5.19, 238.84) = 3.86$, $p = .002$, $\eta_p^2 = .07$, $\beta = .95$. In fact, LA IPV perpetrators scored higher than controls during preparatory and recovery periods (p < .05 in both cases). Additionally, LA IPV perpetrators presented higher RR values during preparatory, task and recovery periods than HA IPV perpetrators and controls ($p < .001$ in all cases).

Finally, there was a significant 'group' effect for SCL, $F(2, 92) = 3.62$, $p = .030$, $\eta_p^2 = .07$, $\beta = .66$, and RR, $F(2, 92) = 11.49$, $p < .001$, $\eta_p^2 = .20$, $\beta = .99$, with LA IPV perpetrators showing higher SCL and RR than controls ($p = .025$ and $p < .001$, respectively). Moreover, differences were found between groups in AUCg for SCL, $F(2, 92) = 3.51$, $p = .034$, $\eta_p^2 = .07$, $\beta = .64$, and RR, $F(2, 92) = 9.75$, $p < .001$, $\eta_p^2 = .27$, $\beta = .65$, LA IPV perpetrators having higher values than controls ($p = .029$ and p =.030). Furthermore, they also had a higher RR AUCg than HA IPV perpetrators ($p < .001$) (see Figure 1 and 2).

No significant effects of 'period x group' or 'group' were observed for HR, PEP, HF or RSA. Furthermore, there were no differences in AUCi or AUCg in these variables.

Figure 1. *SCL average in response to acute stress for IPV perpetrators (with different levels of alcohol consumption) and controls (*p < .05).*

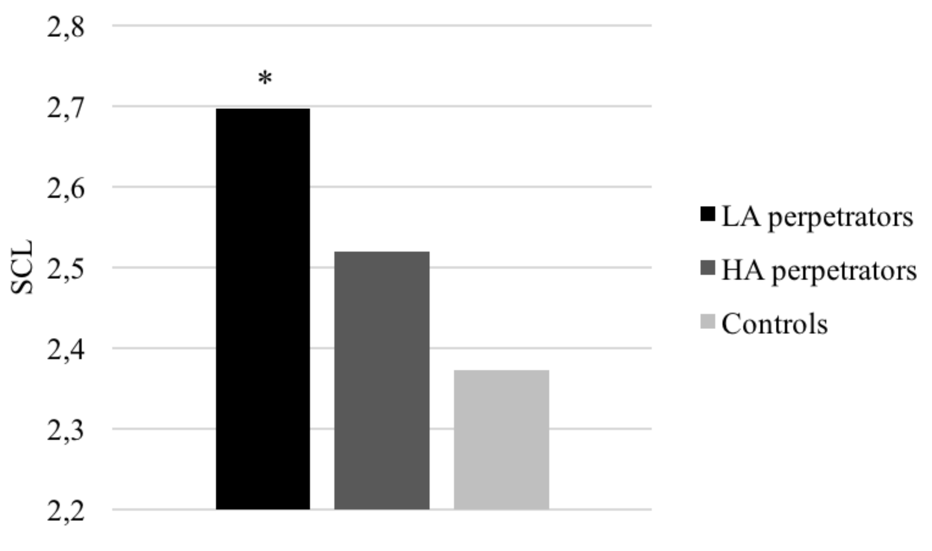
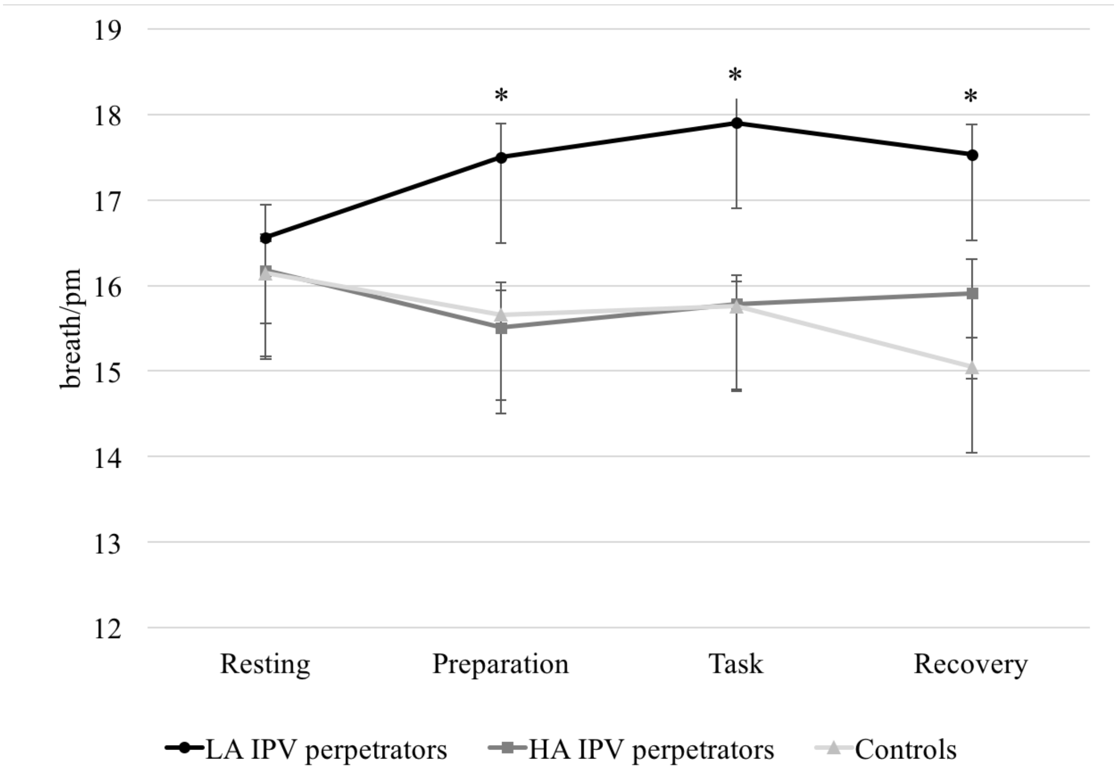


Figure 2. *RR (breath//pm) in response to acute stress (with different levels of alcohol consumption) and controls (*p < .05).*



Discussion

The aim of this study was to analyze the profile, and the psychological (state) and ANS (electrodermal and cardiorespiratory) response to a set of cognitive tests of two groups of IPV perpetrators with different levels of alcohol consumption in comparison with these variables in non-violent individuals (controls). The present study found that IPV perpetrators (both groups) scored higher in self-reported executive dysfunctions and impulsivity (poor self-control, planning abilities and physiological behavior control) than controls. Additionally, both groups of IPV perpetrators showed larger decreases in positive affect, less satisfaction and higher external locus of control than controls after tasks ended. Regarding psychophysiological variables, our data also demonstrated that LA IPV perpetrators presented higher SCL and RR reactivity, especially during preparatory, task and recovery periods than controls. Nevertheless, no differences were found between groups in HR, RSA, or PEP.

The laboratory task, which can be considered a cognitive stressor and has previously been validated in clinical and normative population employing hormonal, immunological and psychophysiological parameters (Romero-Martínez & Moya-Albiol, 2017a; 2017b), proved to be effective in modifying emotionality and psychophysiological state in our study. All participants showed a significant decrease in positive affect, increases in SCL, HR, and RR, and shortening of PEP from resting to the task periods. Further, the finding of a preparatory increase in psychophysiological parameters replicates the results of previous research in which participants were confronted with different laboratory tasks involving auditory or gustatory stimuli, or recognition of human faces (Dawson et al., 2000). The preparatory period is associated with increases in sympathetic activation (shorter PEP values) and this is normally followed by a decrease to the recovery period and increases in parasympathetic activation (higher HF and RSA values) (Sjörs et al., 2009), as we found in both IPV perpetrator groups and non-violent controls. On the other hand, the pattern for coping with stress differed between violent and non-violent groups, but without differences among IPV perpetrators by alcohol intake. In fact, all the IPV perpetrators rated their cognitive performance in front of a committee more negatively than controls (although we did not offer real feedback on their performance). Moreover, they attributed their performance to external factors, unlike controls, who assumed that they had control over their performance in laboratory tasks. These results in IPV perpetrators may reflect low self-esteem and insecurity. In this sense, this different way of coping with stress (different attribution) may offer an explanation of the impact of novelty in psychophysiological regulation in IPV perpetrators. Notably, however, psychophysiological differences were marked in LA IPV perpetrators and controls, but not in HA IPV perpetrators. Below, we will discuss a possible explanation for these differences or lack thereof.

We initially hypothesized that reactive IPV perpetrators would show a sympathetic predominance and lower vagal activation in response to stress, especially individuals with lower alcohol consumption (Karpyak et al., 2014; Romero-Martínez et al., 2013a; 2014). Specifically, impulsive IPV perpetrators tend to be characterized by an 'electrodermal lability', which entails sustained sympathetic activation (shorter PEP and lower vagal values) even when the stressor has ended (Dawson et al., 2000; Romero-Martínez et al., 2013a; 2014). Even though IPV perpetrators had higher self-reported executive deficits and impulsivity traits than controls (with no differences between IPV perpetrators with different levels of alcohol consumption), our data did not support the idea of a sympathetic predominance in impulsive IPV perpetrators. A possible reason for the lack of differences between groups in psychophysiological parameters could be the stressor employed. Previous research (Romero-Martínez et al., 2013a; 2014) employed a psychosocial stressor (TSST) with an emotionally charged topic for IPV perpetrators, but the present study employed a purely cognitive stressor, not designed to activate an emotional response in any particular group, which does not interfere or explain abnormal psychophysiological activation in IPV perpetrators. Thus, our study indicates that it would be necessary to conduct additional studies which confront IPV perpetrators with different types of stimulus in order to demonstrate whether this type of aggressor presents a differential/specific pattern of psychophysiological activation or whether the activation depends on the stimulus/stressor presented.

Romero-Martínez et al. (2014) concluded that impulsive IPV perpetrators showed higher general activation/arousal (HR and NSCR values) during the recovery period, but differences were only observed between LA IPV perpetrators and controls in breathing intervals (RR). As HR as well as RR may contribute considerably to HRV regulation and there is complex feedback between the two parameters (Gąsior, Sacha, Jeleń, Zieliński, & Przybylski, 2016: Reijman et al., 2016), we consider that our results partially agree with previous research. Moreover, our data supports the view that arousal is heightened in impulsive individuals (Zhang et al., 2015) in that LA IPV perpetrators, who scored higher in impulsivity traits, presented higher SCL than controls.

Regarding the effects of alcohol on psychophysiological activation, our study has found a higher sympathetic activation in LA IPV perpetrators during the task and recovery period than the resting period, and this pattern was not found in HA IPV perpetrators or controls, and higher activation of the parasympathetic system in the recovery than in the preparatory period only in the HA group and controls. These results are partially congruent with the hypothesis that alcohol plays a core role in IPV perpetration (Capaldi, Knoble, Shortt, & Kim, 2012; Pinto et al., 2010; Romero-Martínez & Moya-Albiol, 2013; Umhau et al., 2002), alcohol consumption producing a cushioning in the ANS response in this group of violent men with high alcohol consumption. Nevertheless, despite our study showing a higher activation of the LA IPV perpetrators, specifically during the recovery period when the stressor has ended, it did not offer certainty concerning how alcohol disrupts ANS regulation, this predisposing the individual to aggressive behavior in IPV perpetrators. Tentative explanations for the lack of significant results can be offered as follows. The criterion employed to classify the sample, namely, alcohol abuse, although previously employed and validated (Cao et al., 2015; Cho et al., 2012; Scoccianti et al., 2016), has not be used in previous research on IPV perpetrators. Second, there is no clear understanding of what amount of alcohol or how many years of sustained alcohol consumption are necessary to disrupt ANS regulation (Chida et al., 1994; Chida, Takasu, & Kawamura, 1998; Mukherjee, 2013; Zambotti, Willoughby, Baker, Sugarbaker, & Colrain, 2015). Moreover, it is not clear whether ANS disruptions can be exclusively explained by acute alcohol consumption rather than chronic use but without consumption during the research conducted. Finally, our sample is relatively young and the participants had not been clinically diagnosed with AUD. Overall, further research is needed to clarify the ANS disruption associated with alcohol consumption.

This study is part of an ongoing research effort to improve our understanding of why IPV perpetrators use violence against their partners. Even though the present study provides important information to improve our understanding of factors predisposing men to IPV, several limitations should be recognized. First, the modest sample size and the cross-sectional nature of our study could make it difficult to generalize the results obtained. Hence, further studies should be performed with a larger sample size and to check whether our results can be replicated. Another limitation is the absence of a non-violent alcoholic control group, but it is really difficult to identify a group of alcoholic men, who are still consuming alcohol, that agree to voluntarily participate in research. Nonetheless, our data are novel as no studies have examined electrodermal and cardiorespiratory responses to an acute laboratory stressor in IPV perpetrators.

In conclusion, the present study extends previous psychophysiological research in this field, allowing to us to extend our knowledge about how perpetrators' ANS reacts to different stressful situations. This is an effort to simulate daily life situations (marital conflict, psychosocial stress, cognitive stress, etc.) and to understand how IPV perpetrators cope with acute stress in order to develop specific interventions to improve their self-regulation. Even though we are in the early stages of developing this type of rehabilitation strategy, it seems that neurofeedback offers a possibility to reduce impulsivity and to improve behavioral inhibition. Moreover, the analysis of these psychobiological variables together with neuropsychological assessment could be used to define perpetrator typologies, which in turn, would make it possible to develop more specific prevention and intervention programs. Hence, a deep knowledge of ANS regulation in IPV perpetrators could help to develop methods for use as an adjuvant to current psychotherapy based on neurofeedback training to increase batterers' behavior self-regulation, in turn increasing adherence to rehabilitation interventions and reducing the risk of IPV recidivism in the long term.

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Chapter 6

Study 5. Emotional and autonomic dysregulation in abstinent alcoholic men: an idiosyncratic profile?

Under review in: Romero-Martínez, A[1]., Vitoria-Estruch, S[1]., & Moya-Albiol, L[1]. Emotional and autonomic dysregulation in abstinent alcoholic men: an idiosyncratic profile? *Journal of Studies on Alcohol and Drugs.*

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Introduction

It's common that alcoholic abusers experience an increase in negative affect following cessation of chronic alcohol abuse (Dermody, Cheong, & Manuck, 2013; Mezquita, Ibáñez, Moya, Villa, & Ortet, 2014; Studer, Baggio, Dupuis, Mohler- Kuo, Daeppen, & Gmel, 2016). Negative affect has been defined as a dispositional tendency toward negative emotions such as anxiety, anger, a worsening of mood, among others (Steptoe, Wardle, & Marmot, 2005). This dysphoric state is a key feature to maintain excessive alcohol consumption and/or to precipitate relapse in those who choose to abstain from alcohol abuse (Lee, Coehlo, McGregor, Waltermire, & Szumlinski, 2015). In fact, the induction of negative affect in laboratory paradigms tend to increase the necessity to drink (Birch et al., 2004; Cooney, Litt, Morscse, Bauer & Gaupp, 1997; Lee et al., 2015; McGrath, Jones, & Field, 2016; Sinha et al., 2009).

It appears that negative affect may entail difficulties regulating emotions to cope effectively with high stress situations, increasing the risk of relapsing in alcohol consumption (Bekh Bradley et al., 2011; Salsman, & Linehan, 2012). Among alcoholic men exposed to stress, those with higher emotional dysregulation and an impaired inhibitory control were more likely to subsequently relapse in comparison with those with lower dysregulation and higher inhibitory control. Conversely, men who improved in his emotional regulation following treatment had better outcomes than those men with less improvement (Berking, Margraf, Ebert, Wupperman, Hofmann, & Junghanns, 2011). An hypothesis to explain this phenomenon could be that men who misuse alcohol present problems to tolerate negative emotions, which may prone to alcohol consumption and/or relapse in order to avoid, minimize, and/or alleviate distress (negative reinforcement) (Berking et al., 2011). Moreover, research suggest that the dispositional tendency to negative affect in alcoholic men may compromise problems with acknowledging, recognizingand and regulating emotional states, which could be defined as alexithymia (Brown et al., 2013; Timoney & Holder, 2013). In fact, an important number of alcoholics present higher levels of alexithymia, which has been directly associated with the severity of alcoholism and the duration of alcohol abuse (Uzun, Ates, Cansever, & Ozsahin, 2003).

Autonomic activity underlies emotion regulation because it modulates that the body acts in accordance with an emotion, supporting regulatory cognitive efforts to control emotions and/or contributing to modulating the emotional experience (Kahle, Miller, Lopez, & Hastings, 2016). A physiological correlate of difficulties in regulating emotions is the reduction of autonomic flexibility (e.g., the excess or the defect of physiological reactivity to stress) being the beat-to-beat variability of heart rate (HR), which is known as heart rate variability (HRV), a good marker of this autonomic flexibility (Berna, Ott, & Nandrino, 2014; Ganesha, Thirthalli, Muralidharan, Benegal, & Gangadhar, 2013; Williams, Cash, Rankin, Bernardi, Koenig, & Thayer, 2015). Under stress or danger conditions, the autonomic nervous system (ANS) favours sympathetic dominance orver parasympathethic influence to enable adaptive survival response. Conversely, cardiac autonomic function tends to preserv energy by increasing vagal (parasympathetic) outflow over sympathetic influence under resting conditions (Beaumont, Burton, Lemon, Bennett, Lloyd, & Vollmer-Conna, 2012; Obrist, Lawler, Howard, Smithson, Martin, & Manning, 1974). Hence, resting or in response to stress autonomic dysregulations may be perceived as ego-dystonic and not under male who misuse alcohol conscious control, increasing the negative affect (Bitler et al., 1994; Margolin et al., 1988).

The majority of the studies assessing emotion reaction to stress employed ANS indicators, which are based on cardiovascular measurements such as HR, respiration rate (RR), thoracic impedance, the cardiac pre-ejection period (PEP) and respiratory sinus arrhythmia (RSA), among others. Additionally, an electrodermal indicator such as skin conductance levels (SCL) could also be employed as a marker of emotional arousal (Romero-Martínez, Lila, Williams, González-Bono, & Moya-Albiol, 2013; Sariñana-González, Romero-Martínez & Moya-Albiol, 2017). HR and RR regulation is a complex feedback system between the sympathetic and parasympathetic components of the ANS, but this index is unable to convey the complexity of heart regulatory processes (Umhau, George, Reed, Petrulis, Rawlings, & Porges, 2002). For that, other markers of sympathetic and parasympathetic should be employed. With respect to the sympathethic components, the PEP is a systolic time interval, which reflects cardiac contractility as an indicator of β1-cardiac adrenergic influences (Reyes del Paso, Langewitz, Mulder, Van Roon, & Duschek, 2013). Regarding the parasympathetic components, the high frequency (HF) band represents effects of respiration on HR, being associated higher HF with higher parasympathethic activation (Reyes del Paso et al., 2013). Moreover, an additional parasympathethic marker known as RSA is obtained as a result of the interaction between the respiration and vagal control over the heart (de Geus, Willemsen, Klaver, & van Doornen, 1995).

As it was previously explained, there is a complex relation between alcohol misuse and stress response. Accordingly, stress could be partially responsable to the development and maintenance of alcohol misuse, but it seems that alcohol itself tend to alter responses to stress (e.g. alterations in ANS) (Karpyak, Romanowicz, Schmidt, Lewis, & Bostwick, 2014). In fact, a systematic review stablished that alcohol-dependent subjects exhibited lower HRV (the variation of the time interval between heartbeats) than non-alcoholic subjects during 5-10 minutes resting periods or over 24-h registrements. Moreover, higher alcohol consumption (higher than 30gr/day) within a more orless long-term periods (around 15 years) tend to be associated with decreases in indices reflecting vagal modulation, which entails a parasympathetic influence decreasement on HRV, but HRV (vagal control) increases significatively in alcohol-dependent subjects after an abstinence of 6 months (Karpyak et al., 2014). This lack of the parasympathethic activation to control HRV entails problems to regulate ANS during stressful and/or conflict situations, which may disrupt or interfere in the emotional modulation. Additionally, this poor autonomic regulation contributes to a wider array of negative affect expression (Romero-Martínez et al., 2013; Romero-Martínez, Nunes-Costa, Lila, González-Bono, & Moya-Albiol, 2014; Umhau et al., 2002). Unfortunatelly, there is a gap in the scientific literature analysing whether this autonomic and emotional dysregulation in alcoholic men persist after long-term periods of ininterrumpited abstinence (higher than 1 year) as an idiosyncratic profile of alcoholic men.

With all this in mind, our primary objective in the present study was to investigate whether long-term abstinent alcoholic men (LTAA) would exhibit a differential emotional and psychophysiological (cardiovascular and electrodermal) response to an acute laboratory standarized stressor from non-alcoholic control group. Based on the emotional and autonomic dysregulation (reduction of parasympathethic activation) present in men with chronic heavy consumption of alcohol (Karpyak et al., 2014), we expect that LTAA exhibit higher negative affect and a lower parasympathethic activation in response to acute stress in comparison with nonalcoholic group. Furthermore, due to the negative relationship between alexithymia, emotion dysregulation and vagal activation of HRV (Ganesha et al., 2013; Karpyak et al., 2014), it is also hypothesized that higher alexithymic traits and negative affect would be associated to reduced parasympathetic predominance, particularly in LTAA group. The analysis of these variables and their interactions, in particular psychophysiological patterns of stress reactivity, may help to create a risk profile for alcohol misuse and relapse.

Method

Participants

The final sample was composed of 70 healthy men volunteers (36 LTAAs and 34 controls). LTAAS perpetrators participants were recruited from the community psychological and psychoeducational treatment program (AVEX). Moreover, participants were also recruited from the community by postings at Alcoholics Anonymous (AA) meetings, mailings and subject referrals. Inclusion criteria in the current study were admission for Alcohol Use Disorder (AUD) on alcohol assessed by the DSM 5; participants who have been abstinent for a minimum of twelve months (Fein et al., 2006); age above 18 years; and ability to understand and speak Spanish. Exclusion criteria were suffer from any neurologic or psychiatric disease such as Alzheimer's or any type of dementia, past history of stroke or brain injurys, encephalopathy, and refusal to participate. All the individuals who were candidate participants were interviewed by trained researchers (with extensive experience treating AUD) to assess their mental health. Cohen's kappa, used to assess inter-rater agreement between qualitative interviewers in the nine psychopathological dimensions evaluated (the same dimensions as the Symptom Checklist 90-R, SCL-90-R), ranged from .67 to .84. Regardless of the SCL-90-R scores, the interviewees were considered not to have any psychopathological signs and symptoms if they scored less than the mean for their age for each dimension. They were then considered eligible to participate if the qualitative interviews and SCL-90-R scores confirmed they were free of mental illness.

Controls were recruited via internet advertisements and posting flyers around our city from January, 2016 to August, 2016. Inclusion criteria were that they had similar socio-demographic characteristics to the experimental groups, alcohol consumption lower than 30 g/day, and less than two DSM-5 symptoms of AUD. High alcohol consumption was operationally defined as alcohol intake higher than 30 g/day (Cao, Willett, Rimm, Stampfer, & Giovannucci, 2015; Cho, Lee, Rimm, Fuchs, & Giovannucci, E. L. 2012; Scoccianti et al., 2016).

All participants were right-handed and healthy, were properly informed about the research protocol and gave written informed consent. The research was conducted taking into account current ethical and legal guidelines on the protection of personal data and research with human beings in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of our University (H1348835571691).

Procedure

Each subject participated in two sessions in the psychobiology laboratories of the University of Valencia. In the first sessions, participants were interviewed to exclude any individuals with organic diseases. After arriving at the laboratory, participants were taken to a room where they signed informed consent forms and anthropometric data (height and weight) were obtained. Then, participants were asked about their consumption of alcohol and cigarettes, in terms of both the amount consumed and how long they had been abstinent. Subsequently, they completed an inventory based on DSM-5 to check for the presence of AUD, and the Fragerström test of nicotine dependence to assess addiction level. Lastly, they were asked if they had a history of traumatic brain injury, noting whether they had lost consciousness during the trauma; for example, had they been involved in fights, and if so, how often had this resulted in head injuries and had they had blackouts after these injuries. Finally, other psychological tests were studied in order to assess alexithymic participants' traits.

During the second experimental session, which lasted approximately 85 min., ECG was continuously recorded and monitored out of sight of the participant. All subjects remained seated during the entire recording period and ECG signals were continuously registered. Participants were instructed to abstain from eating, taking caffeine, alcohol, or exercise, and any drug 2 hr before arriving at the laboratory. Moreover, if any of participants was a smoker, he was asked to smoke previously to the laboratory assessment to avoid any bias related to the abstinence of nicotine.

Before starting the laboratory procedure, three questionnaires for measuring psychological states (STAI-T, STAXI-2, and POMS) were completed. The procedure included the following periods: resting, preparation, tasks (a set of cognitive tests) and post-task (recovery) and each period lasted 5 minutes, except the post-task (recovery) and task periods, which lasted 10 and 60 minutes, respectively. All participants were exposed to a laboratory stressor, which consists in sixty minutes in front of a committee of a men and a woman while participants perform a set of cognitive tasks. This stressor was an adapted version of the Trier Social Stress Task (TSST), a standardized protocol for the induction of moderate psychosocial stress in laboratory settings (Kirschbaum, Pirke, & Hellhammer, 1993). This variation of the TSST has been previously validated for our laboratory in several samples (de Andrés-García, Moya-Albiol, & González-Bono, 2012; Romero-Martínez, de Andrés-García, Ruiz-Robledillo, González-Bono, & Moya-Albiol, 2014).

After the laboratory stressor, participants completed a brief task appraisal questionnaire, comprising four items based on previous studies (de Andrés-García et al., 2012; Romero-Martínez et al., 2013). Perceived stress and satisfaction were assessed using two items, and ranked on a 10-point Likert scale from 0 (low stress and dissatisfied, respectively) to 10 (high stress and satisfied, respectively). The third evaluated internal (e.g., personal effort and physical and technical abilities) and external (e.g., luck) attribution of the outcome and ranged from 0 (low external locus of control) and 10 (high external locus of control). Psychological state variables (STAI-S, STAXI-2 and POMS) were administrated after the psychosocial stressor.

The end of the assessment was marked by displaying a sign saying "Thank you very much", participants were paid €20 for their participation and told that they could leave.

Psychological state and trait profiles

State anxiety was assessed using the Spanish adaptation (Seisdedos-Cubero, 1982) of the “State-Trait Anxiety Inventory” (STAI-S) (Spielberger, 1970), which contains 20 items, ranked on a 4-point Likert scale. The reliability coefficient was 0.86.

Anger expression was measured by an adapted version (Miguel-Tobal et al., 2001) of the State-Trait Anger Expression Inventory-2’ (STAXI-2) (Spielberger, 1999). This test contains four subscales: anger expression out, anger expression in, anger control out, and anger control in. To increase power for effect size it was calculated a general anger expression index (S-Ang) by the average of the three anger state scales. The Cronbach’s alpha was 0.80.

Mood states were by a suitably validated version (Fuentes, Balaguer, Meliá, & García-Merita, 1995) of the Profile of Mood States (POMS) (McNair, Lorr, & Droppleman, 1992). This test is made of 29 Likert-point items grouped into five subscales (tension, depression, anger, vigor, and fatigue). All the scales apart from vigor stated negative mood. A total score was calculated by adding all the negative scales and substracting vigor (POMSt). The reliability coefficient was 0.86.

Alexithymic traits were measured by the Spanish version (Pérez-Rincón, Cortés, Ortíz, Peña, Ruíz, & Díaz-Martínez, 1997) of the Toronto Scale of 20 Elements (TAS-20) (Bagby, Parker & Taylor, 1994). It is a scale of 20 Likert type reagents with 6 variation points per element (from 0 to 5). The Cronbach’s alpha was 0.80.

Electrophysiological recording

A physiological recording system Vrije Universiteit Ambulatory Monitoring System (VU-AMS; Amsterdam, The Netherlands) was used to capture, process, and analyze data regarding electrocardiogram (ECG), impedance signals and SCL. This is a non invasive ambulatory measurement of the ANS. Seven 'Kendall ARBO H98SG ECG electrodes', whose inch are 55 mm, were arranged on the participant's chest for measurement of the ECG and Impedance Cardiogram (ICG) in accordance with manufacturer instructions and previous research (de Geus et al., 1995; Klaver, de Geus, & de Vries, 1994; Willemsen, DeGeus, Klaver, VanDoornen, & Carrofl, 1996).

During the session continuous time series of R wave-to-R wave intervals and respiration rates were registered from a three-lead electrocardiogram and a four-lead impedance cardiogram.

Regarding electrodermal markers, SCL was recorded through two AgAg/Cl electrodes attached with Velcro straps to the medial phalanx surfaces of the middle and index fingers of the non-dominant hand. A 0.5 V constant voltage procedure was used with a sample rate of 100 ms.

For this study we employed HR, RR, thoracic impedance and SCL as well as valid indicators of parasympathetic and sympathetic cardiac activity such as heart rate variability (HF), PEP and RSA (de Geus et al., 1995; Klaver et al., 1994; Willemsen et al., 1996).

Data analysis

T-tests with Levene's test for equality of variances and/or Chi square analyses were performed where appropriate were used to check for significant differences in age, BMI and socio-demographic variables (LTAAs and control men). Effect sizes for the between-group differences were calculated using Cohen's d (Cohen, 1988).

The Shapiro-Wilk test was used for exploring whether the data were normally distributed. Due to the fact that the majority of psychophysiological variables did not meet the assumption of normality ($p < .05$), therefore, these variables were log- transformed.

For psychological state responses, repeated measures ANOVAs with "moment" (pre and post) as the within-subject factor and 'group' as the between-subject factor were performed. Change score for psychological state variables were obtained as the differences between post-stress minus pre-stres scores.

For cardiovascular and electrodermal measures, the effectiveness of the stressor in the total sample was confirmed by general linear model repeated measures ANOVA with 'period' (at four levels: resting, anticipatory period, tasks and recovery) as a within- subjects factor. To examine group effects, repeated measures ANOVA was conducted with 'period' as the within-subject and 'group' as the between-subject factors. Moreover, there were carried out repeated measures ANCOVAs if there were differences between groups in resting values, including as covariates those resting values. Greenhouse-Geisser corrections for degrees of freedom and Bonferroni corrections for multiple comparisons were applied where appropriate. For significant results, partial eta squared (ηp2) is reported as a measure for effect size.

Analysis of the AUC enabled cardiovascular and electrodermal responses to the stressor to be quantified, using the trapezoid formula originally employed for estimating the magnitude of hormonal responses (Pruessner et al., 2003). To achieve this, differences between each of the four periods (instructions, preparation period, stressors and recovery) and the resting period were summed to obtain a single AUC.

Spearman and Pearson correlations were used for relationships between psychophysiological resting and reactivity with psychological state variables where appropriate. Bonferroni corrections for multiple comparisons with p value of .05 were applied following the recommendations of Curtin and Schulz (1998).

Data analyses were performed using SPSS 22.0 (SPSS IBM). All reported p- values are two-tailed, and $p \leq 0.05$ was considered significant. Average values are expressed as mean ± SEM.

Results

Participant Characteristics and appraisal scores long-term abstinent alcoholics (LTAAs) did not differ from controls in age (47.00+9.71 and 42.65+10.69, respectively), BMI (27.79+4.00 and 27.24+5.05, respectively) or socio-demographic variables (see table 1). Nonetheless, there were found differences between groups for resting values of specific cardiovascular (HF, RSA, PEP and RR). In fact, LTAAs group presented lower HF, RSA, shorter PEP values and higher RR than controls. Therefore, there were included as covariates in ulterior analysis. LTAAs scored similar appraisal scores to controls in perceived stress (3.50+2.05 and 2.82+2.02, respectively); but LTAAs differ from controls in internal (7.15+1.49 and 8.15+0.96, respectively), and external control index (3.06+1.68 and 1.85+0.96, respectively) and satisfaction (6.47+2.11 and 8.06+1.413, respectively). In fact, LTAAs presented lower internal control index and satisfaction than controls. Moreover, LTAAs scored higher in external control index than controls.

Table 1. *Mean ± SD of descriptive characteristics for all groups (*p < .05).*

	LTAAs (n=36)	**Controls (n=35)**
Age (years)	47.00±9.72	42.94±10.83
BMI (Kg/m²)	27.79±4.00	27.32±4.99
Nationality		
Spanish	97%	80%
Latin Americans	3%	20%
Marital status* **		
Single	25%	-
Married	33%	100%
Separate/Divorced/Widowed	42%	-
Number of children	.94±1.01	1.05±0.91
Level of education		
Primary/lower secondary	47%	43%
Upper secondary/vocational training	39%	43%
University	14%	14%
Employment status		
Employed	45%	46%
Unemployed	55%	54%
Income level		
1800€ – 12000€	63%	64%
12000€ – 30000€	30%	31%
> 30000€ – 90000€	7%	5%
Personal history of traumatic brain injury		
Yes	48.14%	40%
No	51.85%	60%
Temporary loss of consciousness		
Yes	29.36%	40%
No	70.37%	60%
Alcohol Use Variables		
Age started drinking	17.74±8.82	-
Age at first heavy use	22.75±7.92	-
Average lifetime drinking dose (gr/day)	197.61±153.69	
Duration of active drinking (years)	26.64±11.98	-
Time of alcohol abstinence (months)	39.53±77.77	-

Family members with AUD	Yes	37%	-
	No	63%	-
Fagerstrom test		4.84±3.91	3.17±1.11

Laboratory task

Psychological responses to the laboratory task

For anxiety, a significant ‘group’ effect was found [(F(1, 68) = 4.17, p = .045, ηp2 = .060]; with LTAAs presenting higher anxiety levels than controls (14.05+1.17 and 10.74+1.13, respectively). Nevertheless, there were not found significant effects of ‘moment’ and/or ‘moment x group’ interaction. Change score did not reveal differences between groups in anxiety (-1.18+7.06 and 0.00+0.00, respectively).

Regarding S-Ang, a significant effect of “moment” and ‘group’ was found [(F(1, 68) = 3.97, p = .050, ηp2 = .054; F(1, 69) = 1713.99, p < .001, ηp2 = .961]. All participants experienced a slightly decrease in their states of S-Ang after the task, with LTAAs having higher S-Ang than controls (15.69+0.18 and 5.17+0.18, respectively). Change score did not reveal differences between groups in S-Ang (-5.00+1.68 and -0.11+0.72, respectively).

When analyzing mood, the laboratory task was shown to be efficient for eliciting mood alterations, since the factor ‘moment’ [(F(1, 69) = 14.71, p < .001, ηp2 = .176] and ‘moment x group’ interaction [(F(1, 69) = 4.92, p = .030, ηp2 = . 067] were found. Although both groups experienced worse moods after the task, it was worse in the case of LTAAs than controls (100.03+10.46 and 94.23+9.83, respectively). Change score revealed differences between groups (t69 = 2.22, p = 030, d = .53), with LTAAs experiencing worse mood after the task in comparison with controls (5.67+8.16 and 1.51+7.60, respectively).

Effectiveness of the laboratory acute stressor to elicit cardiovascular responses

The psychosocial stressor employed in this study was found to be effective, as indicated by the significant ‘period’ effect on HR in the total sample [ε=.61, F(1.84, 126.85) = 31.27, p < .001, ηp2 = .312]. After dividing the sample by groups, intra-group comparisons revealed a significant ‘period’ effect in both LTAAs [ε=.49, F(1.46, 51.03) = 8.51, p = .002, ηp2 = .196] and controls [ε=.62, F(1.85, 61.06) = 33.98, p < .001, ηp2 = .507]. In LTAAs, HR increased from resting to the anticipatory period. Afterwards, HR decreased from then to recovery (for all $p < .05$). In controls, HR followed a similar pattern to the LTAAs (for all $p < .05$).

Regarding HF, the laboratory task proved to be efficient for eliciting HF changes, since the factor 'period' was significant [ε=.76, $F(2.28, 157.53) = 26.00$, $p < .001$, $\eta p2 = .027$]. After dividing the sample by groups, intra-group comparisons revealed a significant 'period' effect in both LTAAs [ε=.62, $F(1.86, 63.32) = 31.65$, $p < .001$, $\eta p2 = .482$] and controls [ε=.75, $F(2.26, 76.91) = 5.53$, $p = .004$, $\eta p2 = .140$]. In LTAAs, HR increased from resting to the preparatory period. Afterwards, HF decreased from preparatory to tasks period and from then increased to recovery (for all $p < .05$). In controls, HF followed a similar pattern to the LTAAs (for all $p < .05$).

In the case of RSA, a significant 'period' effect was found in the total sample [$F(3, 207) = 22.11$, $p < .001$, $\eta p2 = .243$]. After dividing the sample by groups, intra-group comparisons revealed a significant 'period' effect in both LTAAs [$F(3, 105) = 21.12$, $p < .001$, $\eta p2 = .376$] and controls [$F(3, 94) = 5.11$, $p = .004$, $\eta p2 = .134$]. In LTAAs, RSA values increased from resting to the anticipatory period and from then to recovery (for all $p < .05$). The vagal ratio followed a similar pattern in controls (for all $p < .05$). Regarding PEP, the laboratory task proved to be efficient for eliciting PEP changes, since the factor 'period' was significant [ε=.88, $F(2.64, 182.27) = 2.99$, $p = .038$, $\eta p2 = .042$], but after dividing the sample by groups the factor 'period' did not reached statistical significance for LTAAs and/or controls.

In the RR case, the laboratory stressor proved to be efficient in eliciting RR changes in the total sample [ε=.81, $F(2.44, 168.33) = 9.19$, $p < .001$, $\eta p2 = .117$]. After dividing the sample by groups, intra-group comparisons only revealed a significant 'period' effect in LTAAs [ε=.63, $F(1.89, 66.44) = 14.08$, $p < .001$, $\eta p2 = .287$]. In this group, RR values decreased from resting to the anticipatory period and from then to tasks. Afterwards, RR increased from then to recovery (for all $p < .05$).

Regarding thoracic impedance, no significant 'time' effect was found. Nevertheless, after dividing the sample by groups, only the "period" was significant in LTAAs [ε=.64, F(1.93, 67.38) = 3.17, p = .050, ηp2 = .083]. In fact, thoracic impedance values decreased in LTAAs from resting to the anticipatory period and from then to tasks. Afterwards, thoracic impedance increased from then to recovery (for all p < .05).

In the SCL case, the laboratory stressor proved to be efficient in eliciting SCL changes in the total sample [ε=.65, F(1.94, 133.61) = 5.44, p = .006, ηp2 = .073]. After dividing the sample by groups, intra-group comparisons only revealed a significant 'period' effect in LTAAs [ε=.77, F(2.32, 81.08) = 4.85, p = .007, ηp2 = .122]. In LTAAs, SCL increased from resting to the anticipatory period. Afterwards, SCL decreased from anticipatory to tasks and increased from then to recovery (for all p < .05).

Differences between LTAAs and controls in cardiovascular and electrodermal responses to the laboratory task

In the case of HR, there was not found significant 'group' or 'period x group' interaction effects. Additionally, there were not found differences between groups in AUCi HR.

With regards to HF, a significant effect of 'period x group' interaction was found [F(2, 134) = 9.73, p = .028, ηp2 = .066] , although post-hoc test did not reveal differences between groups, LTAAs presented a slightly lower recovery values than controls. Moreover, there were differences between groups in AUCi HF (t69 = 2.82, p = 006, d = .68), with LTAAs presenting lower HF increases than controls.

Regarding the RSA, a significant effect of 'period x group' interaction was found [F(2, 134) = 3.49, p = .033, ηp2 = .050] , with LTAAs having lower RSA values than controls in the preparatory and task periods (p < .05) (Figure 1). Furthermore, there were differences between groups in AUCi RSA (t59.08 = 2.26, p = 027, d = .54), with LTAAs presenting lower RSA increases than controls.

In the case of PEP, a significant 'group' effect was found [F(1, 68)= 11.47, p = .001, ηp2 = .144], with LTAAs having shorter PEP values than controls (Figure 2). Additionally, there were differences between groups in AUCi PEP (t59.08 = 1.99, p = 050, d = .48), with LTAAs presenting lower PEP increases than controls. Regarding the RR, a significant effect of ‘period x group’ interaction was found [ε=.90, $F(1.80, 120.73) = 11.76$, $p < .001$, $\eta p2$ = .149] , with LTAAs having higher RR values than controls in the preparatory and recovery periods ($p < .05$). Additionally, there were differences between groups in AUCi RR ($t59.08$ = -2.09, p = 040, d = .50), with LTAAs presenting lower RR increases than controls.

In the case of thoracic impedance and SCL, there was not found significant ‘group’ or ‘period x group’ interaction effects. However, there were not differences between groups in AUCi thoracic impedance and SCL.

Relationships between psychological and cardiovascular responses to the laboratory acute stressor for both groups were summarized in table 2 and 3.

Table 2. *Relationships between alexhymitic traits with psychological state profiles (STAI, STAXI-2 and POMS) in LTAA and controls. * p < .05, ** p < .01.*

	STAI-S baseline		STAI-S change score		STAXI-2 baseline		STAXI-2 change score		POMS baseline		POMS change score	
	LTAAs	**controls**	**LTAAS**	**controls**	**LTAAS**	**Controls**	**LTAAS**	**controls**	**LTAAS**	**controls**	**LTAAS**	**controls**
TAS total score	.321*	.404	-.045	.000	.022	.325	.041	-.326	.416*	.234	-.056	.116
STAI-S baseline			-.571**	.000	.333*	.503**	-.291	.248	.382*	.811**	.111	.266
STAI-S change score					.042	.000	.054	.000	-.121	.000	.340*	.000
STAXI-2 baseline							-.821**	-.827**	.155	.531**	.312*	-.499**
STAXI-2 change score									-.118	-.296	-.129	.474**
POMS baseline											-.287	-.387**
POMS change score												

Table 3. *Relationships between cardiovascular and electrodermal parameters (with psychological state profiles (STAI and S-Ang) in LTAA and controls * p < .05, ** p < .01.*

	HR resting		**HR AUCi**		**HF resting**		**HF AUCi**		**RSA resting**		**RSA AUCi**	
	LTAA	**Control**	**LTAA**	**Control**	**LTAA**	**Control**	**LTAA**	**Control**	**LTAA**	**Control**	**LTAA**	**Control**
TAS total score	-.093	-.137	.087	.133	.150	.133	.057	-.079	.199	-.027	-.053	.089
STAI-S baseline	.262	.085	-.271	-.080	.043	.135	.169	-.093	-.017	-.078	.076	.204
STAI-S change score	-.074	.000	.119	.000	-.052	.000	.094	.000	-.031	.000	-.107	.000
STAXI-2 baseline	.284	-.047	-.243	.006	-.059	.091	.281	.004	-.163	.184	.288	-.034
STAXI-2 change score	**-.341***	.080	.248	-.037	.197	-.019	-.145	-.046	300	-.141	-.272	.053
POMS baseline	.263	-.058	-.263	.056	.011	.123	.049	-.097	.008	-.015	-.013	.092
POMS change score	.327	-.115	-.255	.078	.96	-.050	.015	.056	.023	.018	.028	-.030

	PEP resting		**PEP AUCi**		**RR resting**		**RR AUCi**		**Thoracic impedance resting**		**Thoracic impedance**		**SCL**		**SCL AUi**	
	LTAA	**Control**	**LTAA**	**Control**	**LTAA**	**Control**	**LTAA**	**Control**	**LTAA**	**Control**	**LTAA**	**Control**	**LTAA**	**Control**	**LTAA**	**Control**
TAS total score	**-.398***	-.099	**-.352***	-.071	.199	.266	-.255	.089	-.173	-.025	.168	-.060	.207	-.141	-.215	.230
STAI-S baseline	-.082	.205	-113	-.185	.265	.202	-.274	-.256	.001	.122	.006	-.161	.160	.125	-.043	-.113
STAI-S change score	.050	.000	.213	.000	.124	.000	-.08	.000	.048	.000	.010	.000	-.062	.000	.010	.000
STAXI-2 baseline	**.363***	-.048	.060	-.025	**.460****	.113	**-.544****	-.130	-.050	.197	.061	-.211	.307	.197	.355	-.211
STAXI-2 change score	**-.244**	.157	-.030	-.116	**-.439****	-.237	**.513****	.234	.029	.075	-.037	-.087	-.052	.075	.098	-.087
POMS baseline	**.494****	**.430****	**-.412****	-.294	-.024	.231	.066	-.207	.082	.104	-.093	-.123	.166	.153	-.104	-.160
POMS change score	-.038	.019	.018	-.060	.154	.114	-.049	-.068	.106	-.408	-.108	.133	.156	.052	-.160	-.054

Figure 1. *RSA values (ms) during resting, preparation, stressors and recovery periods for groups (LTAAs and controls) *p<.05.*

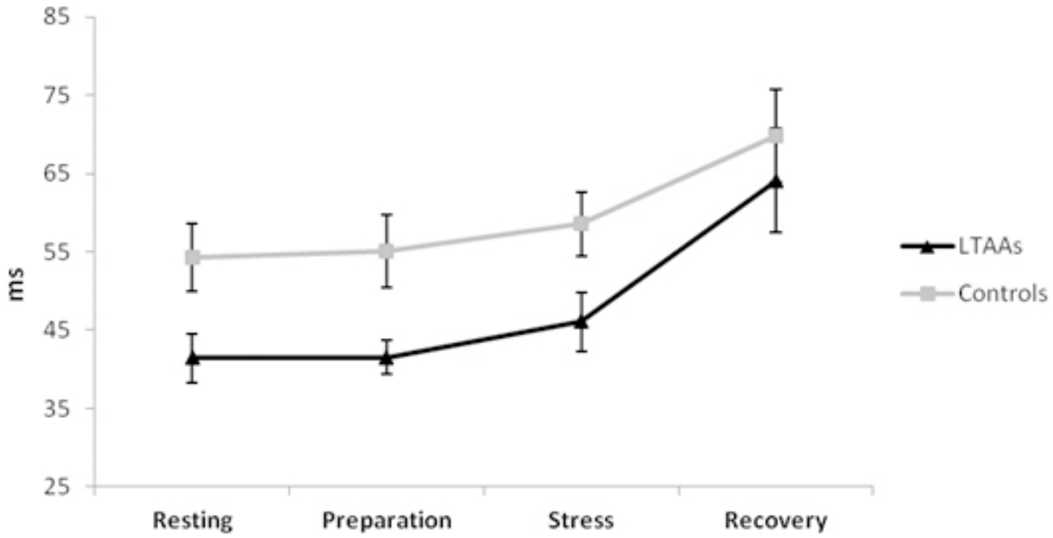
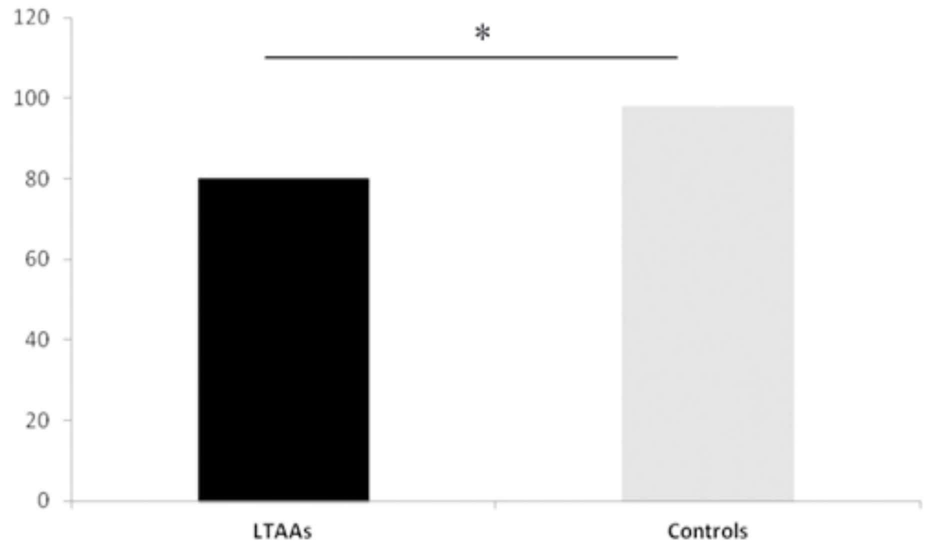


Figure 2. *PEP values (ms) for LTAAs and controls *p<.05.*



Discussion

LTAA men experienced slight increases in anxiety and anger state in response to a set of laboratory tasks and a moderate worsening of mood in comparison with non- alcoholic control men. Moreover, the former exhibited lower HF and RSA values, shorter PEP values and higher RR than controls, particularly during preparatory and recovery periods. Nevertheless, there were not registered differences between the two groups in HR, SCL, thoracic impedance and their magnitude of response. Finally, alexithymic traits implies higher worsening of mood and sympathethic predominance (shorter PEP values and magnitude of response), especially in LTAA group. Moreover, negative affect was positively related to sympathethic predominance in this group.

The validity of the employed laboratory acute stressor was demonstrated by a significant increase in negative affect (high anxiety and anger) and changes in cardiovascular an electrodermal variables in all participants. In fact, these differences between groups remained significant even after including as covariates resting values. This reinforces the results as the obtained differences are not caused by a baseline emotionally state that drives differently the response to laboratory acute stress. Both groups presented a significant increase in HR and PEP from resting to stress period and a decrease in parasympathethic markers. It has been previously pointed out that this acute laboratory stressor, as an acute psychosocial stress, produces an immediate increase in HR in healthy non-violent adults (Romero-Martínez & Moya-Albiol, 2017). This increase in HR is normally followed by a decrease at the recovery period (Kudielka et al., 2004), as we found in all participants. Nevertheless, LTAA presented worse recovery than controls, as they maintained higher PEP values and lower HF and RSA once the stressful period was finished.

The first objective of the present study consists of determining whether LTAA men report higher negative affect and lower parasympathethic activation in response to acute stress than controls. Initially, the LTAAs men arrived at the laboratory in a worse mood than controls, as they reported significantly higher scores before laboratory task in anxiety and anger state than controls. Moreover, they experienced higher sympathethic (shorter PEP and higher RR values) and lower parasympathethic activation (RSA values) during resting period in comparison with controls, which is line with previous research in this field (Karpyak et al., 2014). It is possible that this is the way how LTAAs cope with novel situations. In fact, the low HRV exhibited by the LTAAs group in comparison with controls to cope with novelty may be a peripheral indicator of cognitive rigidity. In this sense, previous research indicated that LTAAs present a cognitive profile characterized by executive dysfunctions (Romero-Martínez, Vitoria-Estruch, & Moya-Albiol, under review). Although sympathetic influences on the heart are normally intense to cope with the stress (Beaumont et al., 2012), the LTAA group present a sympathethic activation even before they recieved the instructions to the laboratory acute stress. A possible reason for this psychophysiological and psychological predisposition to cope with novelty could be the alexithymicfeatures of LTAAs group. In this sense, alexithymia has been associated to the adoption of several inadaptive coping strategies such as behavioral disengagement, emotional inhibition and/or avoidant coping (Velasco, Fernández, Páez, & Campos, 2006) Zeidner & Matthews, 2000). Thus, as both groups were "forced" to confront novelty of the laboratory situation may be LTAAs group feel overwhelm by the anticipation of social evaluative threat (e.g. assess your cognitive skills, interact with strangers, provide personal data...). Taking these results together, the alexithymia of LTAA men may conditionate the way in which LTAAs cope with potentially stressful and novel stimuli, perceiving as a threat.

After presenting the acute laboratory stressor, LTAA men reported more negative affect (increases in anxiety and anger state and a moderate worsening of mood), a reduction of parasympathethic activation (lower RSA and HF) and a higher sympathethic activation (shorter PEP values and higher RR) in response to acute stress than controls, as expected. These results agree with those found in men with chronic heavy consumption of alcohol (Karpyak et al., 2014). In fact, heavy alcohol consumers tend to exhibit an increase in parasympathethic control of HRV after prolonged abstinence, but still remains reduced in comparison with non-alcoholics (Karpyak et al., 2014). As it was previously explained, this differential psychophysiological and psychological response to acute stress could be partially explained by the alexhitimic traits, which interfere in the ability to cope with stress. Additionally, the analysis of the appraisal after the laboratory stress demonstrated a differential ability to confront this situation. In fact, LTAA exhibited lower satisfaction with their performance on the cognitive tests and higher external locus of control than non-alcoholic abusers. An explanation to this result can be found in a previous research, whose authors concluded that as higher scores on alexithymia, higher external locus of control and less confidence in participants' own abilities (Hexel, 2003). Thus, the sympathethic predominance and the reduction of the vagal control of the HRV in LTAAs could be considered as a differential pattern of response to stress of heavy alcohol consumers as a result of alexithimic traits, which tend to modulate increasing the negative affect.

Regarding the second aim of the present study, it was obtained that a worsening of mood was associated to a shortened PEP response to stress, especifically in LTAA group. In other words, in LTAAs higher negative affect implies an intense sympathethic and lower parasympathethic activation in response to stress. Thus, higher negative affect could disrupt normal cognitive processes that would otherwise increase levels of sympathetic arousal (Houston, 1994) and in turn motivate alcohol relapse and/or misuse. Nevertheless, we only provided correlational data in our study, therefore, further research is needed to clarify the actual role of these variables or their interactions.

This study is part of an ongoing research effort to improving our understanding of how LTAA respond to acute psychosocial stress. Indeed, the research design is strong because it includes a control group which was matched for major demographic characteristics and it also includes good sympathethic and parasympathethic markers. The major limitation of the study is the limited sample size. For this reason, the findings should be considered as preliminary and, furthermore, research is needed to explore these patterns in larger samples. Although this is the first study to examine cardiovascular and electrodermal activity with LTAA, the experiment was not the proper setting for address causal relationships between variables since it was a cross-sectional study. Hence, and all of these questions should be considered in future studies.

In conclusion, our study reveals that LTAA men presented high sympathethic activation before and after novelty situations. Moreover, only in LTAA negative affect drives their cardiovascular and electrodermal reactivity to stress. For this reason, we suggest that cardiovascular measures of both sympathetic and parasympathetic branches of the ANS could be valid diagnostic indicators for alcohol misuse. Our previous papers also provided evidence of potential differences in neuropsychological parameters between subjects, with or without history of alcohol misuse. Hence, the present data offer a wider explanation of the LTAA with a better understanding of the interactions between the ANS and the psychological state in LTAA. Finally, the findings from this research would permit one to build new LTAA risk profiles based on biological and neuropsychological markers, as well as develop effective treatment and prevention programs, which should introduce the use of biological markers of LTAA.

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Chapter 7

DISCUSSION

The findings of this research provide an in-depth view of the role of alcohol consumption in the cognitive processes of IPV perpetrators, in addition to characterizing the psychophysiological response to a laboratory task. IPV perpetrators, specifically those with a high-risk level of alcohol use, showed greater cognitive deficits than perpetrators with a low-risk level of alcohol use and non-violent men, and a higher parasympathetic activation than perpetrators with a low-risk level of alcohol use. Moreover, the effect of alcohol on cognitive functions and psychophysiological response was analyzed in a group of abstinent alcoholic men, without IPV history, compared to non-alcoholic men. The former showed higher cognitive deficits and higher sympathetic response than non-alcoholic men.

As we hypothesized, there were neuropsychological differences between IPV perpetrators with high and low alcohol consumption and controls that were not heavy drinkers and had no history of violence (Aresi et al., 2016; Beck et al., 2014; Catalá-Miñana et al., 2013; Heinz et al., 2011; Lila, 2013; Lila et al., 2017). HA IPV perpetrators had more severe impairments in attention shifting and cognitive flexibility than LA IPV perpetrators, and significantly more impairments than controls in attention shifting, working and long-term memory, planning and decision-making (Vitoria-Estruch et al., 2017; Vitoria-Estruch, Romero-Martínez, Lila, & Moya-Albiol, 2018). Furthermore, LA IPV perpetrators, in turn, showed less working and long-term memory and executive functioning than controls. In this regard, the cognitive deficits observed in IPV perpetrators could interfere in the planning, initiation and regulation of behavior and social adjustment, thus facilitating the adoption of risk behaviors and seeking extreme sensations in a context of impulsivity, anxiety, and/or aggressiveness (Heinz et al., 2011). Therefore, this poor regulation of behavior would lead them to fail to use the information available in the environment, and to select immediate reinforcements without taking into account the future consequences of their acts (Gutnik, Hakimzada, Yoskowitz, & Patel, 2006; Kravitz et al., 2015; Leykin, Roberts, & DeRubeis, 2011; Oscar-Berman & Marinković, 2007; Staples & Mandyam, 2016).

Moreover, as we expected, the observed executive dysfunction, specifically the lack of mental flexibility, was related to more sexist ideas about their partners and higher levels of anger expression (Vitoria-Estruch et al., 2017, 2018; Romero-Martínez et al., 2014). In addition, IPV perpetrators with a higher hostile sexism had a lower perception of the severity of their actions (Vitoria-Estruch et al., 2017). It could be possible that the prejudicial attitudes and discriminatory behaviors that hostile sexism entails, make perpetrators to blame the victim and to feel less personal responsibility of their acts (Cárdenas et al., 2010; Gracia et al., 2011; Gracia & Herrero, 2006; Gracia & Tomás, 2014; Lila, Gracia, & García, 2013; Romero-Martínez et al., 2013a; Teichner et al., 2001). This hostile sexism, in addition to the observed high trait anger and anger expression, could be related to a series of personal features that impair the cognitive process (Houston, 1994), and it has also been related to feelings such as contempt, resentment, and/or disgust. All this, in turn, could predispose them to the incidence and recidivism of the violent behavior (Gracia et al., 2011; Gracia & Herrero, 2006; Gracia & Tomás, 2014; Lila et al., 2013). Our results are congruent with this idea because IPV perpetrators had higher levels of executive dysfunction, impulsivity, disinhibition, and use of more aggressive strategies, instead of using negotiation or empathic cooperation tactics to resolve conflicts, than controls (Vitoria-Estruch et al., 2017; Vitoria-Estruch et al., 2018).

Regarding the empathic skills assessment in IPV perpetrators, it was observed that HA IPV perpetrators had higher empathic deficits than the LA IPV perpetrators and controls (Vitoria-Estruch et al., 2017, 2018). These deficits could be observed in problems with identifying emotions and understanding others' feelings and thoughts. This could lead to misunderstandings, giving a negative connotation to their partners' intentions or feelings and promoting inappropriate reactions or violent behavior in stressful or tense situations (Romero-Martínez et al., 2013a; Romero-Martínez & Moya-Albiol, 2013; Thoma et al., 2013). This marked deficit could be explained by their low cognitive flexibility (Vitoria-Estruch et al., 2017), impaired attention shifting skills and slow processing speed, which could interfere in the proper social relations establishment (Romero-Martínez et al., 2016a; Vitoria et al., 2017). This partially clarifies why certain individuals engage in risky and antisocial behaviors (Dethier & Blairy, 2012; Zonneveld, Platje, de Sonneville, Goozen, & Swaab, 2017; West, Drummond, & Eames, 1990). Furthermore, antisocial behaviors have been considered robust predictors of IPV (Capaldi, Knoble, Shortt, & Kim, 2012) and IPV recidivism (Romero-Martínez et al., 2016b). In this regard, our results suggest that HA IPV perpetrators may be more likely to exhibit antisocial traits and/or behaviors than the rest of the participants, due to their empathic impairments.

Although alcohol consumption could predispose men to violence by altering a set of important cognitive functions, it cannot be considered a direct causal factor in violence because not all IPV perpetrators consume alcohol, and not all alcohol consumers are violent. Hence, a group of alcohol abstinent men (LTTA), without history of violence, was analyzed in order to characterize their neuropsychological functioning. As initially hypothesized, the LTAA group presented deficits in processing speed, sustained attention, working and long-term memory, cognitive flexibility and planning, as well as higher disinhibition and impulsivity than controls. These cognitive impairments were more evident for LTAA who drank for a longer period of time and had the shortest abstinence. However, they did not differ from the controls in empathic skills (Romero-Martínez, Vitoria-Estruch, & Moya-Albiol, 2018). On the one hand, these findings support our previous results suggesting that chronic hazardous alcohol use affects the correct functioning of cognitive processes, which could increase the risk of disinhibition and impulsivity, as well as a lack of concern for the consequences of inappropriate behaviors (Kravitz et al., 2015; Staples & Mandyam, 2016). On the other hand, focusing on the lack of empathic skill deficits, these results might highlight the importance of a good understanding of the partner's thoughts and feelings as a possible protective factor against violent behaviors because LTAA is a group without a history of violence. However, all these findings agree with previous studies showing that alcohol consumption is not a direct cause of violence, and they show the need to continue to study the heterogeneous and complex profile that lies at the base of the violent behavior from a biopsychosocial point of view. However, it would be possible to consider the information of the present study in clinical treatment for alcoholics and abstinent men, working with all neuropsychological impairments in the prevention of relapses and, given the high incidence of IPV related to alcohol consumption, the prevention of possible aggressive behavior (Cafferky, Mendez, Anderson, & Stith, 2018; Crane, et al., 2016; Easton & Crane, 2016; Langenderfer, 2013).

Regarding the effects of alcohol on psychophysiological activation, we hypothesized that current alcohol consumption would have a depressive effect on ANS activity in HA IPV perpetrators (Mukherjee, 2013). Hence, we analyzed the psychological and ANS response to a laboratory task of two groups of IPV perpetrators with different levels of alcohol consumption compared to a non-violent and non-alcoholic control group. IPV perpetrators (both groups) showed higher scores on self-reported executive dysfunctions, impulsivity and external locus of control of their performance, and less positive affect and satisfaction than controls (Vitoria-Estruch, Romero-Martínez, Lila, & Moya-Albiol, under review). As expected, a lower sympathetic activation was found in HA IPV perpetrators than in LA IPV perpetrators. Hence, based on our initial hypothesis, we can conclude that high alcohol consumption might diminish the ANS response to stress (Mukherjee, 2013; Vitoria-Estruch et al., under review). This alteration in SNA activity could interfer in the adequate perpetrators' response to changing situations in their environment, and facilitates the appearance of violent and/or antisocial behaviors as a compensation mechanism (Crouch et al., 2015; Karpyak et al., 2014). These results are partially congruent with previous studies, possibly due to methodological differences in each research (Capaldi et al., 2012, Pinto et al., 2010, Romero-Martínez & Moya-Albiol, 2013; Umhau et al., 2002).

Additionally, we decided to analyze the psychophysiological response to the same laboratory task in a sample of LTAA without an IPV history, in order to find out if there is a specific response pattern in abstinent alcoholic men due the effect of alcohol consumption on ANS activity. The LTAA group presented an increase in negative affect, lower satisfaction with their performance on the cognitive tests, and a higher external locus of control than non-alcoholic men. Moreover, they showed higher sympathetic activation compared to controls (Romero-Martínez, Vitoria-Estruch, & Moya-Albiol, under review). This differential psychophysiological response to acute stress could be partially explained by the alexithymic traits and participants' lower confidence in their own abilities (Karpyak et al., 2014; Velasco, Fernández, Páez, & Campos, 2006). Thus, given to they had to confront the novelty of the laboratory situation, LTAA group may have felt overwhelmed by the anticipation of social evaluative threat (e.g. assess your cognitive skills or the personal data provided...). It is possible that the observed hyperactivation underlies their maladaptive coping and lack of emotional regulatory control.

As our results show, alcohol consumption has a different psychophysiological effect on HA IPV and LTAA. Namely, HA IPV perpetrators shown a higher parasympathetic response to the laboratory task, and LTAA men shown a higher sympathetic activation. These results could be due to the fact that, although both groups were considered separately as heavy drinkers compared to controls, the consumption of the LTAA group is significantly higher than HA IPV perpetrators. This makes direct comparisons between both groups difficult. In addition, other variables could have interfered in our results, for example, the previous state of participants, being an active or abstinent alcohol consumer, the consumption of other drugs, the criterion employed to classify the sample (Cao, Willett, Rimm, Stampfer, & Giovannucci 2015; Cho, Lee, Rimm, Fuchs, & Giovannucci, 2012; Scoccianti et al., 2016) or the amount of alcohol or the number of years of sustained alcohol consumption necessary to disrupt ANS regulation (Chida et al., 1994; Chida et al.,1998; Mukherjee, 2013; Zambotti, Willoughby, Baker, Sugarbaker, & Colrain, 2015).

Although this study represents an advance in our understanding of predisposing factors of IPV, its limitations should be considered in interpreting the results and designing future studies. First, cross-sectional data were used rather than longitudinal data, and, hence, definitive conclusions cannot be drawn about the long-term effects of alcohol in IPV because we do not know their previous state, and so causal relationships between the variables analyzed have to be considered with caution. Another limitation was the difficulty in finding a group of alcoholic men who are still consuming alcohol and agree to voluntarily participate in research. Although we initially collected inpatients from an alcohol abuse clinic, the majority of them were in an abstinence period of more than twelve months (LTAA group). Moreover, the IPV perpetrators who participated in our study actively consume alcohol, for this reason, these groups were not directly comparable. However, IPV perpetrators and LTAA were compared to the same control group, and having the same reference group in all analyses allows us to achieve a better interpretation of the results.

Nonetheless, this study has a number of strengths. Our data are novel because no studies have examined the neuropsychological profile and electrodermal and cardiorespiratory responses to an acute cognitive laboratory stressor in IPV perpetrators with different levels of alcohol consumption and in LTAA, compared to matched controls. Moreover, we were able to acquire data from a real sample of IPV perpetrators in the phase prior to their participation in an intervention and rehabilitation program, thus adding more reliability to our results. At the same time, we also had the opportunity to analyze this sample after the intervention program had ended, obtaining an objective measure of its effectivity and an indicator of the aspects that continue to need work. In addition, regarding the methodology, we combined a rapid exhaustive computer-based neuropsychological assessment battery with pencil-and-paper measures, which allows us to establish a complete IPV perpetrator profile. Likewise, the stressor used in this study, without emotional connotations for any group in the sample, would be an indicator of a possible specific reactivity of IPV perpetrators, which has not been shown in previous studies.

The present Ph.D. thesis is designed to improve our understanding of the neuropsychological and psychophysiological profiles of IPV perpetrators, which may underlie their predisposition to violence. This information, in turn, has important implications for the prevention and treatment of IPV (Fox, Brook, Stratton, & Hanlon, 2016; Hanlon, Brook, Stratton, Jensen, & Rubin, 2013; Pinto et al., 2010; Rhodes, Rodgers, Sommers, Hanlon, & Crits-Christoph, 2014). The findings of the present research could be useful in developing more adapted and effective prevention and intervention programs, increasing the perpetrators' adherence to the rehabilitation intervention, and, in turn, reducing the risk of IPV recidivism in the long term. This information could be useful in establishing criteria for inclusion of aggressor in such programs, and assessing the effectiveness of intervention programs. Moreover, the outcomes of this study, along with personality and psychosocial variables, could also be applied in judicial processes in order to help to establish the sentence of the perpetrators when they are in court order, by guiding the assessment of their recidivism risk. Thus, future research should aim to provide a more nuanced look at the role of alcohol consumption in the neuropsychological functioning and psychophysiological profile in IPV, as well as protective factors that prevent other men with poor neuropsychological functioning from engaging in IPV. The development of this kind of research, along with the contributions of social and personality psychology, allows us to work on reducing the incidence and recidivism of this social problem.

Conclusions

Keeping in mind the objectives proposed in the introduction section of this Ph.D. thesis, the most important final conclusions are detailed below:

- IPV perpetrators, specifically those with high alcohol consumption, manifest more extensive neurocognitive dysfunction, specifically more executive, switching attention, memory, and empathic impairments, than non-violent individuals.
- Alcohol consumption is related to less cognitive flexibility in IPV perpetrators. Moreover, IPV perpetrators with a lower cognitive flexibility presented less cognitive empathy, more hostile sexism, higher trait anger and anger expression, and a lower perception of severity of their violent acts.
- Abstinent alcoholic men manifested more neuropsychological dysfunctions (executive functions, sustained attention and memory) compared to controls, although no differences were found in empathic skills.
- IPV perpetrators who were heavy drinkers showed lower sympathetic predominance and higher vagal regulation in response to stress than IPV perpetrators with low alcohol consumption.
- The LTAA group showed higher negative affect and lower parasympathetic activation in response to acute stress compared to controls.

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Capítulo 1

INTRODUCCIÓN

La violencia contra la mujer en las relaciones de pareja hombre-mujer representa un grave problema de salud pública a nivel mundial. Se ha estimado que aproximadamente una de cada tres mujeres (35%) en el mundo han sufrido violencia física o sexual por parte de su pareja, y/o violencia sexual por terceras personas en algún momento de sus vidas. Además, el 38% de los asesinatos de mujeres son cometidos por su pareja (Organización Mundial de la Salud, OMS, 2016). Teniendo en consideración las consecuencias negativas que conlleva este tipo de violencia para la salud física, psicológica, sexual y reproductiva de las víctimas (Martínez, Sánchez-Lorente, & Blasco-Ros, 2010; Vil, Carter, & Johnson, 2018), y el elevado impacto económico y coste social que supone para las sociedades occidentales (OMS, 2016), es fundamental llevar a cabo estudios en los que se identifiquen los principales factores de riesgo que predisponen a la conducta violenta. Esto permitiría desarrollar programas de prevención e intervención más adaptados a las características de los agresores y, por lo tanto, más efectivos en la reducción de la incidencia y la reincidencia de la violencia contra la mujer (OMS, 2016).

En los últimos años se han logrado avances significativos en la investigación científica sobre los factores psicológicos predisponentes a la violencia contra la mujer en las relaciones de pareja. Sin embargo, la prevalencia en nuestra sociedad continúa alcanzando niveles alarmantes, y aún quedan muchas preguntas por resolver para lograr una mejor comprensión y prevención del problema (Heise, 1998, 2011; Heise & Kotsadam, 2015; Jewkes, 2002; Jewkes, Flood, & Lang, 2015). Una forma interesante de entender cómo los agresores pueden presentar predisposición a realizar este tipo de violencia sería estudiar cómo procesan ellos la información de su entorno, mediante la evaluación de diferentes variables neuropsicológicas (Pinto et al., 2010; Romero-Martínez & Moya-Albiol, 2013). En este sentido, en un estudio de revisión sistemática se observó que, en comparación con hombres no violentos, los hombres que habían ejercido violencia contra su pareja presentaban una mayor disfunción ejecutiva, un mayor deterioro de la memoria y de la atención, así como una peor capacidad empática (Romero-Martínez & Moya-Albiol, 2013). Así pues, los déficits cognitivos observados conllevarían una mayor dificultad en la resolución de conflictos a través de mecanismos conciliatorios, como la negociación o la cooperación, lo que haría más probable la aparición de la conducta violenta (Farrell, 2011). Igualmente, estudios previos han sugerido que la disfunción ejecutiva observada en los agresores, especialmente la falta de flexibilidad cognitiva, podría explicar parcialmente por qué los hombres que han cometido violencia contra su pareja suelen mantener ideologías sexistas y comportamientos rígidos, que interfieren en la adaptación de su conducta a las situaciones cambiantes del entorno y dificultan que aprendan de sus propios errores o castigos (Romero-Martínez, Lila, Martínez, Pedrón-Rico, & Moya-Albiol, 2016a; Romero-Martínez, Lila, & Moya-Albiol, 2016b; Romero-Martínez, Lila, & Moya-Albiol, 2016c; Romero-Martínez & Moya-Albiol, 2013). De este modo, las ideologías sexistas y la falta de empatía en los agresores harían que ellos mismos perciban sus acciones como menos graves, lo que podría facilitar el comportamiento violento (Cárdenas, et al., 2010; Gracia, García, & Lila, 2011; Gracia & Herrero, 2006; Gracia & Tomás, 2014; Thoma et al., 2011). No obstante, los estudios realizados hasta el momento no han tenido en consideración el papel del consumo de alcohol en los déficits cognitivos mencionados. Por lo tanto, sería fundamental estudiar la posible relación del consumo de alcohol con la disminución de la regulación del comportamiento, y cómo esta asociación estaría mediada por los déficits cognitivos en los agresores.

Estudios previos coinciden en indicar que el consumo de alcohol aumenta el riesgo de perpetración de la violencia contra la mujer en las relaciones de pareja (Cafferky, Mendez, Anderson, & Stith, 2018; Eckhardt, Parrott, & Sprunger, 2015; Foran & O’Leary, 2008; Langenderfer, 2013), pero se conoce muy poco sobre las variables que podrían influir en esta relación. Por lo tanto, sería necesario llevar a cabo estudios que analicen las variables mediadoras de esta relación como, por ejemplo, los déficits cognitivos y los correlatos psicofisiológicos (Bayless & Harvey, 2017; Romero-Martínez, Lila, Sariñana-González, González-Bono, & Moya-Albiol, 2013a; Romero-Martínez et al., 2016a; Romero-Martínez & Moya-Albiol, 2013; Thomas, Bennett, & Stroops, 2012).

Un alto porcentaje de hombres que han cometido violencia contra su pareja presentan un elevado consumo de alcohol y/o han llevado a cabo los actos violentos bajo la influencia del alcohol (Catalá-Miñana et al., 2017; Crane, Godleski, Przybyla, Schlauch, & Testa, 2016; Easton & Crane, 2016; Klostermann & Fals-Stewart, 2006; Eckhardt, Parrott, & Sprunger, 2015; Lila, Gracia, Catalá-Miñana, Santirso, & Romero-Martínez, 2016; Lila, Gracia, & Catalá-Miñana, in press; López-Caneda et al., 2014; Romero-Martínez et al., 2016b; WHO, 2016). En este sentido, se ha sugerido que el alcohol podría actuar como un depresor del Sistema Nervioso Central (SNC), aumentando la activación límbica e inhibiendo el funcionamiento de la corteza prefrontal. Así pues, esta afectación podría explicar en parte las alteraciones observadas en determinados procesos cognitivos necesarios para la correcta regulación del comportamiento y el ajuste social, como son, el razonamiento lógico y la toma de decisiones (Heinz, Beck, Meyer-Lindenberg, Sterzer, & Heinz, 2011; López-Caneda et al., 2014; Pedrero-Pérez et al., 2009, 2011, 2013; Romero-Martínez et al., 2013a; Romero-Martínez, Lila, Catalá-Miñana, Williams, & Moya-Albiol, 2013b; Romero-Martínez et al., 2016b). No obstante, no todos los hombres violentos presentan un elevado consumo de alcohol, por lo que el alcohol no se podría considerar una causa directa de la violencia contra la mujer en las relaciones de pareja. En este sentido, sería fundamental llevar a cabo una investigación adicional con hombres alcohólicos y abstinentes con el fin de estudiar si existe un perfil específico que predispone o protege de llevar a cabo comportamientos violentos, así como la relación de este perfil con otras variables personales y psicosociales.

El consumo de alcohol también ha sido asociado a diversos efectos psicofisiológicos, incluyendo alteraciones en la actividad del Sistema Nervioso Autónomo (SNA) (Boschloo et al., 2011; Miralles, Espadaler, & Rubiés-Prat, 1995). No obstante, faltaría por esclarecer de qué manera las alteraciones producidas por el alcohol podrían facilitar los comportamientos agresivos (Chida et al., 1994; Chida, Takasu, & Kawamura, 1998; Crouch et al., 2015; Karpyak et al., 2014; Monforte et al., 1995; Mukherjee, 2013; Reed, Porges, & Newlin, 1999; Villalta, Estruch, Antúnez, Valls, & Urbano-Márquez, 1989). Así pues, se ha sugerido que el consumo crónico de alcohol tiende a deprimir el SNC, suprimiendo la actividad de la vía nerviosa excitatoria (Mukherjee, 2013), pero todavía existen inconsistencias sobre si el alcohol tiende a reducir la activación simpática o parasimpática del SNA en situaciones estresantes como, por ejemplo, una situación de conflicto con la pareja (Karpyak et al., 2014; Mukherjee, 2013). En cualquier caso, el alcohol alteraría la variabilidad cardíaca, reduciendo su flexibilidad y capacidad de adaptación a los cambios del entorno (Karpyak et al., 2014), lo que podría facilitar la aparición de comportamientos violentos y/o antisociales (Crouch et al. 2015). Por lo tanto, dada la influencia del SNA en el comportamiento humano (Portnoy & Farrington, 2015; Portnoy et al., 2014; Wilson & Scarpa, 2011), sería conveniente llevar a cabo estudios en los que se analice de qué manera el alcohol podría intervenir en este sistema en los hombres que han ejercido violencia contra la mujer en las relaciones de pareja.

Romero-Martínez et al. (2013a, 2014) estudiaron la respuesta del SNA a una versión modificada del *Trier Social Stress Test* (TSST), en un grupo de hombres que habían cometido violencia contra la mujer en comparación con un grupo de hombres no violentos. En este estudio, los agresores mostraron una mayor hiperreactividad del sistema nervioso simpático en comparación con los controles, y esta hiperreactividad se relacionó con mayores rasgos de impulsividad. El predominio simpático observado en esta población podría ser indicativo de una desregulación del SNA. Así pues, las personas con este perfil psicofisiológico mantendrían altos niveles de vigilancia (o activación), irritabilidad y tensión durante periodos de tiempo sostenidos, reduciendo el umbral al comportamiento violento cuando se exponen a ciertos tipos de estímulos que son incongruentes con sus esquemas cognitivos hostiles, como las ideas sexistas sobre las mujeres o los roles dominantes del hombre en las relaciones de pareja (Dawson, Schell, & Filion, 2000). No obstante, como se ha comentado anteriormente, los resultados son incongruentes y todavía hay inconsistencias sobre la respuesta de estrés del SNA en agresores (Karpyak et al., 2014; Mukherjee, 2013). Estas inconsistencias podrían ser debidas al tipo de estímulo utilizado en cada estudio y/o a la influencia de otras variables como, por ejemplo, el consumo de alcohol, el cual no ha sido incluido en estudios previos, la edad de inicio del consumo, la duración del consumo y/o el tiempo de abstinencia. Esto haría necesario realizar nuevos estudios que consideren este tipo de variables mediadoras para profundizar en los perfiles que caracterizan a los agresores.

La presente tesis doctoral tiene como objetivo establecer el perfil neuropsicológico de los hombres que han cometido violencia contra la mujer en las relaciones de pareja y caracterizar su respuesta psicofisiológica a una tarea de laboratorio, analizando a su vez la influencia del consumo de alcohol. Los objetivos y las hipótesis sugeridas se resumen a continuación:

1. *Examinar el efecto del consumo de alcohol en los procesos cognitivos de hombres penados por violencia contra la mujer en las relaciones de pareja, con diferentes niveles de consumo de alcohol, y hombres no violentos (grupo de control).* Hipotetizamos que los agresores presentarán mayores alteraciones en el funcionamiento cognitivo, específicamente en las funciones ejecutivas, atención, memoria y empatía, que las personas no violentas (Pinto et al., 2010; Romero-Martínez & Moya-Albiol, 2013; Romero-Martínez et al., 2016c). Además, consideramos que dichas alteraciones serán más severas en los agresores con Alto Consumo de Alcohol (ACA) que en los agresores con Bajo Consumo de Alcohol (BCA) y los controles (Aresi et al., 2016; Beck, Heinz, & Heinz, 2014; Catalá-Miñana, Lila, & Oliver, 2013; Heinz et al., 2011; Lila, Gracia, & Català-Miñana, 2017).
2. *Evaluar la relación entre el consumo de alcohol y la flexibilidad cognitiva en los hombres penados por violencia contra la mujer, y su relación con otras variables psicosociales que podrían estar relacionadas con una mayor predisposición a la violencia.* Hipotetizamos que los agresores con ACA presentarán menores niveles de flexibilidad cognitiva que aquellos con BCA (Romero-Martínez et al., 2013a; 2013b; Romero-Martínez & Moya-Albiol, 2013; Romero-Martínez et al., 2016a; 2016b). Dada la asociación entre la flexibilidad cognitiva y otras variables psicosociales relacionadas con la violencia contra la mujer, planteamos que los agresores con baja flexibilidad cognitiva presentarán menor empatía cognitiva (Thoma et al. 2011), mayor sexismo hostil (Cárdenas, Lay, González, Calderón, & Alegría, 2010; Teichner, Golden, Van Hasselt, Peterson, 2001), mayor rasgo y expresión de la ira (Romero-Martínez et al., 2013b), y menor percepción de gravedad de sus actos violentos (Gracia et al., 2011; Lila, Gracia, & García, 2013), en comparación con los agresores con alta flexibilidad cognitiva.
3. *Estudiar los efectos cognitivos del consumo de alcohol en hombres alcohólicos abstinentes (AA) y hombres no alcohólicos (grupo de control), con el fin de establecer perfiles neuropsicológicos diferenciales.* El consumo de alcohol se ha asociado con una mayor predisposición a la violencia contra la mujer en las relaciones de pareja.

No obstante, tal y como se ha comentado, no puede considerarse la única causa de este tipo de violencia. Por lo tanto, se propuso un estudio adicional en hombres alcohólicos con el fin de investigar si existe un perfil específico predisponente o protector de la conducta violenta. Aunque inicialmente contactamos con pacientes de una clínica para el tratamiento del trastorno por consumo de alcohol, la mayoría de los que participaron en nuestro estudio se encontraban en un período de abstinencia de más de doce meses (grupo AA). En cambio, los agresores que participaron en nuestro estudio sí realizaban un consumo activo de alcohol, por lo tanto, los agresores y los AA no eran directamente comparables. Así pues, dada la dificultad por encontrar un grupo de hombres alcohólicos con consumo activo dispuestos a participar en la investigación, se realizó la comparación de los AA con el mismo grupo control que se compararon los agresores previamente. Por lo tanto, a la luz de los hallazgos previos con respecto a los deterioros cognitivos persistentes en pacientes con trastornos por consumo de alcohol después de períodos prolongados de abstinencia (Alhassoon et al., 2012; Nowakowska-Domagała, Jabłkowska-Górecka, Mokros, Koprowicz, & Pietras, 2017; Stavro, Pelletier, Potvin, 2013), planteamos la hipótesis de que los hombres AA manifestarán mayores alteraciones neuropsicológicas en comparación con los controles.

4. *Comparar el efecto del consumo de alcohol sobre la respuesta del SNA a una tarea de laboratorio en un grupo de hombres penados por violencia contra la mujer en las relaciones de pareja, con diferentes niveles de consumo de alcohol, y un grupo de hombres no violentos (controles).* En línea con los resultados de investigaciones previas sobre el efecto del consumo crónico de alcohol sobre la actividad del SNA (Chida et al., 1994; 1998; Monforte et al., 1995; Mukherjee, 2013), hipotetizamos que los agresores con ACA mostraron un menor predominio simpático y una mayor regulación vagal en respuesta al estrés que los agresores con BCA y los controles.
5. *Estudiar el efecto del consumo de alcohol sobre la respuesta psicofisiológica a una tarea de laboratorio en hombres AA, en comparación con un grupo control de hombres no alcohólicos.* Teniendo en cuenta la influencia del alcohol en el funcionamiento del SNA, se propuso analizar si existe un perfil psicofisiológico

específico en los hombres AA que no presentan antecedentes de violencia contra la mujer. Hipotetizamos que los AA presentarán una menor reactividad simpática del SNA en comparación con los controles (Chida et al., 1994, 1998; Monforte et al., 1995; Mukherjee, 2013).

Capítulo 7

DISCUSIÓN

Los resultados de la presente tesis doctoral permiten profundizar en la comprensión de los efectos del consumo de alcohol sobre los procesos cognitivos de los hombres que han cometido violencia contra la mujer en las relaciones de pareja, así como caracterizar su respuesta psicofisiológica a una tarea de laboratorio. Los agresores, especialmente aquellos con ACA, mostraron mayores déficits cognitivos que los agresores con BCA y que los controles, y una mayor activación parasimpática que los agresores con BCA. Igualmente, se analizó el efecto del alcohol sobre el funcionamiento cognitivo y la respuesta psicofisiológica a la misma tarea de laboratorio en hombres AA, sin antecedentes de violencia, en comparación con un grupo control. Así pues, los AA mostraron mayores déficits cognitivos y una mayor activación del sistema simpático en comparación con los hombres no alcohólicos.

Tal y como planteamos en las hipótesis previas, se observaron diferencias en las variables neuropsicológicas entre los agresores con ACA, BCA y controles (Aresi et al., 2016; Beck et al., 2014; Catalá-Miñana et al., 2013; Heinz et al., 2011; Lila, 2013; Lila et al., 2017). Los agresores con ACA presentaron mayores déficits en atención alternante y flexibilidad cognitiva que los agresores con BCA, así como una menor velocidad de procesamiento, flexibilidad cognitiva y mayores déficits en atención alternante, memoria de trabajo y a largo plazo, planificación y toma de decisiones, en comparación con los controles (Vitoria-Estruch et al., 2017; Vitoria-Estruch, Romero-Martínez, Lila, & Moya-Albiol, 2018). Igualmente, los agresores con BCA presentaron una menor capacidad mnésica a largo plazo y un peor funcionamiento ejecutivo que los controles. Los déficits cognitivos observados en los agresores podrían influir negativamente en la planificación, iniciación y regulación del comportamiento, así como en el adecuado ajuste social. Esto podría facilitar la adopción de comportamientos de riesgo y la búsqueda de nuevas sensaciones, dentro de un contexto de impulsividad, ansiedad y/o agresividad (Heinz, 2011). Por lo tanto, esta dificultad en la regulación del comportamiento llevaría a utilizar de forma incorrecta la información disponible en el entorno, y a seleccionar refuerzos inmediatos sin tener en cuenta las futuras consecuencias de sus actos (Gutnik, Hakimzada, Yoskowitz, & Patel, 2006; Kravitz et al., 2015; Leykin, Roberts, & DeRubeis, 2011; Oscar-Berman & Marinković, 2007; Staples & Mandyam, 2016).

Además, como esperábamos encontrar, los défícts en las funciones ejecutivas observados en los agresores, concretamente la falta de flexibilidad cognitiva, se relacionó con una mayor ideología sexista y mayores niveles de expresión de la ira (Vitoria-Estruch et al., 2017, 2018; Romero-Martínez et al., 2014). A su vez, los agresores que presentaron un mayor sexismo hostil percibieron como menos grave su conducta violenta (Vitoria-Estruch et al., 2017). Es posible que las actitudes prejuiciosas y las conductas discriminatorias hacia la mujer que incluye el sexismo hostil, haga que los agresores tiendan a culpabilizar a la víctima de sus actos y, por tanto, tengan un menor sentimiento de responsabilidad (Cárdenas et al., 2010; Gracia et al., 2011; Gracia & Herrero, 2006; Gracia & Tomás, 2014; Lila, Gracia, & García, 2013; Romero-Martínez et al., 2013a; Teichner et al., 2001). Además, el sexismo hostil, junto a un mayor rasgo y expresión de la ira (Vitoria-Estruch et al., 2017), podría predisponer a una serie de características personales que perjudicarían el adecuado funcionamiento cognitivo (Houston, 1994), y facilitarían los sentimientos de desprecio, resentimiento, y/o disgusto. Todo esto, a su vez, podría predisponer a los agresores a la incidencia y reincidencia del comportamiento violento (Gracia et al., 2011; Gracia & Herrero, 2006; Gracia & Tomás, 2014; Lila et al., 2013). Los resultados obtenidos en el presente estudio son congruentes con esta idea, ya que los agresores mostraron mayores niveles de disfunción ejecutiva, impulsividad, desinhibición y un mayor uso de estrategias agresivas para la resolución de conflictos, en lugar de utilizar tácticas de negociación o cooperación empática, en comparación con los controles (Vitoria-Estruch et al., 2017; Vitoria-Estruch et al., 2018).

Respecto a la evaluación de la empatía en los agresores, se observó que aquellos con ACA presentaron mayores déficits empáticos que los agresores con BCA y los hombres no violentos (Vitoria-Estruch et al., 2017, 2018). Los déficits empáticos podrían llevar a problemas en la identificación de las emociones y en la comprensión de los sentimientos y pensamientos de los demás. Esto podría dar lugar a malentendidos en la relación, dada la connotación negativa de las intenciones o sentimientos de la pareja y, por tanto, aumentaría la posibilidad de actuar de forma inapropiada o violenta en situaciones estresantes y de conflicto (Romero-Martínez et al., 2013a; Romero-Martínez & Moya-Albiol, 2013; Thoma et al., 2013). La falta de empatía en los agresores podría explicarse por sus alteraciones en flexibilidad cognitiva (Vitoria-Estruch et al., 2017), atención alternante y velocidad de procesamiento, lo cual interferirían en el adecuado establecimiento de sus relaciones sociales (Romero-Martínez et al., 2016a; Vitoria et al., 2017). Estos resultados explican en parte por qué algunos agresores presentan en mayor medida comportamientos antisociales y conducta de riesgo (Dethier & Blairy, 2012; Zonneveld, Platje, de Sonneville, Goozen, & Swaab, 2017; West, Drummond, & Eames, 1990). Así pues, los comportamientos antisociales se han considerado factores predisponentes a la violencia contra la mujer en las relaciones de pareja (Capaldi, Knoble, Shortt, & Kim, 2012) y a su reincidencia (Romero-Martínez et al., 2016b). En este sentido, nuestros resultados sugieren que los agresores con ACA, debido a sus déficits en empatía, podrían ser más propensos a mostrar rasgos y/o comportamientos antisociales que el resto de los participantes.

Tal y como se ha observado, los efectos del consumo de alcohol sobre las funciones cognitivas podrían predisponer a la conducta violenta. No obstante, el alcohol no se puede considerar como un factor causal directo de la violencia contra la mujer, ya que no todos los agresores consumen alcohol y no todos los consumidores de alcohol son violentos. Por lo tanto, se incluyó en el estudio un grupo de hombres AA, sin antecedentes de violencia, con el objetivo de analizar su perfil neuropsicológico. Tal y como hipotetizamos, el grupo AA presentó mayores déficits en velocidad de procesamiento, atención sostenida, memoria de trabajo y a largo plazo, flexibilidad cognitiva y planificación, así como una mayor desinhibición e impulsividad que los controles (Romero-Martínez, Vitoria-Estruch, y Moya-Albiol, 2018). Estos déficits fueron mayores en los AA con un periodo de consumo de alcohol más largo y un periodo de abstinencia más corto. Sin embargo, no se encontraron diferencias entre los AA y los controles en la capacidad de empatía. Por un lado, estos resultados respaldan nuestros hallazgos previos del efecto negativo que ejerce el consumo crónico de alcohol sobre los procesos cognitivos, lo cual podría aumentar el riesgo de desinhibición e impulsividad, así como la falta de preocupación por las consecuencias de conductas inapropiadas (Kravitz et al., 2015; Staples & Mandyam, 2016). Por otro lado, dada la preservada capacidad empática en los AA, cabe destacar la importancia de una buena comprensión de los pensamientos y sentimientos de la pareja como posibles factores protectores a la conducta violenta, ya que los AA no presentan antecedentes de violencia. Así pues, estos resultados concuerdan con estudios previos al constatar que el consumo de alcohol no puede considerarse una causa directa de la violencia. Igualmente, destacan la necesidad de continuar con el estudio del perfil heterogéneo y complejo que subyace al comportamiento violento desde un punto de vista biopsicosocial. La información obtenida en el presente estudio se podría aplicar en el tratamiento clínico de personas con problemas en el consumo de alcohol y/o abstinentes, con la finalidad de prevenir recaídas y posibles comportamientos agresivos, teniendo en consideración la alta relación entre alcohol y violencia (Cafferky, Mendez, Anderson, & Stith, 2018; Crane, et al., 2016; Easton & Crane, 2016; Langenderfer, 2013).

Respecto a los efectos del alcohol sobre la activación psicofisiológica, hipotetizamos que el consumo de alcohol tendría un efecto inhibitorio sobre la actividad del SNA en los agresores con ACA (Mukherjee, 2013). Por lo tanto, se analizó la respuesta psicológica y fisiológica a una tarea de laboratorio en los dos grupos de agresores, con diferentes niveles de consumo de alcohol, en comparación con un grupo control no violento y no alcohólico. Los dos grupos de agresores mostraron puntuaciones más altas en disfunción ejecutiva autoinformada, impulsividad y locus de control externo sobre la ejecución de la tarea, así como un menor afecto positivo y satisfacción que los controles (Vitoria-Estruch, Romero-Martínez, Lila y Moya-Albiol, en revisión). Igualmente, de acuerdo con nuestra hipótesis inicial, se observó que los agresores con ACA presentaron una menor activación simpática que los agresores con BCA. Por lo tanto, podemos concluir que el consumo crónico de alcohol podría tener un efecto de amortiguación de la respuesta del SNA frente al estrés (Mukherjee, 2013; Vitoria-Estruch et al., en revisión). Esta alteración de la actividad del SNA podría influir en la adecuada respuesta de los agresores a las situaciones cambiantes de su entorno, y facilitar la aparición de comportamientos violentos y/o antisociales como mecanismo de compensación (Crouch et al. 2015; Karpyak et al., 2014). Estos resultados son parcialmente congruentes con los obtenidos en estudios previos, posiblemente debido a diferencias metodológicas de la propia investigación (Capaldi et al., 2012; Pinto et al., 2010; Romero-Martínez & Moya-Albiol, 2013; Umhau et al., 2002).

Se analizó también la respuesta psicofisiológica a la misma tarea de laboratorio en un grupo de hombres AA sin antecedentes de violencia, con el fin de estudiar si presentaban un patrón de respuesta del SNA específico debido al efecto del consumo de alcohol. El grupo AA presentó un aumento en el afecto negativo, una menor satisfacción con la ejecución de las pruebas cognitivas y un mayor locus de control externo que los hombres no alcohólicos. Además, los hombres AA mostraron una mayor activación simpática del SNA en comparación con los controles (Romero-Martínez, Vitoria-Estruch, & Moya-Albiol, en revisión). Esta respuesta psicofisiológica diferencial al estrés agudo podría explicarse en parte por los rasgos alexitímicos y por la menor autoconfianza de los participantes AA en sus propias habilidades (Karpyak et al., 2014; Velasco, Fernández, Páez, & Campos, 2006). Así pues, es posible que el hecho de enfrentarse a la tarea de laboratorio hiciera que el grupo de AA se sintiera abrumado por la anticipación de una posible evaluación negativa (por ejemplo, de sus habilidades cognitivas o de los datos personales proporcionados...). Igualmente, la hiperactivación observada en los hombres AA podría ser la base de su afrontamiento desadaptativo y de la falta de control en la regulación de las emociones.

Tal y como se observa en nuestros resultados, el consumo de alcohol tiene un efecto psicofisiológico diferente en el grupo de agresores y en el de alcohólicos abstinentes. Es decir, los agresores con ACA mostraron una mayor activación parasimpática en respuesta a la tarea del laboratorio, mientras que los hombres AA una mayor reactividad simpática. Estos resultados podrían ser debidos a que, a pesar de considerar que ambos grupos realizaban un alto consumo de alcohol en comparación con los controles, el consumo de los AA era significativamente mayor. Esto hace que sea difícil realizar comparaciones directas entre ambos grupos. Igualmente, podrían haber interferido en nuestros resultados otras variables como, por ejemplo, el estado previo de los participantes, el hecho de ser consumidor activo o abstinente, el consumo de otras drogas, el criterio empleado para clasificar la muestra (Cao, Willett, Rimm, Stampfer, & Giovannucci 2015; Cho, Lee, Rimm, Fuchs, & Giovannucci, 2012; Scoccianti et al., 2016) o la cantidad de alcohol y años de consumo requeridos para alterar la regulación del SNA (Chida et al., 1994; Chida et al.,1998; Mukherjee, 2013; Zambotti, Willoughby, Baker, Sugarbaker, & Colrain, 2015).

El presente estudio supone un avance en la comprensión de los factores predisponentes a la violencia contra la mujer en las relaciones de pareja. No obstante, deben tenerse en cuenta ciertas limitaciones al interpretar los resultados obtenidos y, sobretodo, en el diseño de nuevos estudios. En primer lugar, se trata de un estudio transversal, por lo tanto, resulta difícil extraer conclusiones definitivas sobre los efectos a largo plazo del alcohol en la violencia contra la mujer. Al no conocer el estado previo de los participantes, las relaciones causales establecidas deben ser consideradas con precaución. Otra limitación es la dificultad para encontrar un grupo control de hombres con consumo de alcohol activo y no violentos que accedieran a participar en la investigación. Aunque inicialmente contactamos con pacientes de una clínica para el tratamiento del trastorno por abuso de alcohol, la mayoría se encontraban en un período de abstinencia de más de doce meses (grupo AA). Además, los agresores que participaron en nuestro estudio sí que presentaban un consumo activo de alcohol, por lo tanto, ambos grupos no eran directamente comparables. No obstante, tanto los AA como los agresores se compararon con el mismo grupo control y, al tener el mismo grupo de referencia en todos los análisis, se consiguió una mejor interpretación de los resultados.

Asimismo, el estudio llevado a cabo comporta una serie de avances para la investigación de la violencia contra la mujer. Los datos de nuestro estudio son novedosos, hasta la fecha ningún estudio ha examinado el perfil neuropsicológico y la respuesta psicofisiológica a un estresor de laboratorio de carácter cognitivo en agresores con diferentes niveles de consumo de alcohol y en hombres AA, en comparación con un grupo control. Además, la muestra está compuesta por hombres penados por violencia contra la mujer que todavía no han realizado el programa de intervención y rehabilitación llevado a cabo en el Programa Contexto. Esto hace posible que se puedan evaluar las alteraciones cognitivas observadas tras la finalización de dicho programa de intervención, obteniendo así una medida objetiva de su efectividad, y un indicador de los aspectos que se requiere seguir trabajando. Respecto a la metodología, se administró una completa batería de evaluación neuropsicológica, mediante soporte informático y pruebas de lápiz y papel, lo cual nos permite estudiar el perfil de los agresores de forma completa. Igualmente, el estímulo utilizado como estresor en este estudio, a diferencia de estudios previos, no presentaba connotaciones emocionales para ninguno de los grupos, lo cual serviría como indicador de una posible reactividad específica de los agresores.

La presente tesis doctoral permite ampliar nuestro conocimiento sobre los perfiles neuropsicológicos y psicofisiológicos de los hombres penados por violencia contra la mujer que podrían predisponer a la conducta violenta. Esta información, a su vez, tiene implicaciones importantes para la prevención y el tratamiento de la violencia (Fox, Brook, Stratton, & Hanlon, 2016; Hanlon, Brook, Stratton, Jensen, & Rubin, 2013; Pinto et al., 2010; Rhodes, Rodgers, Sommers, Hanlon, & Crits-Christoph, 2014). Así pues, los hallazgos de la presente investigación son de gran utilidad en el desarrollo de programas de prevención e intervención más adaptados a las características de los agresores. Esto permitirá que aumente la adherencia de los agresores a la intervención de rehabilitación y, a su vez, que los programas sean más efectivos y reduzcan el riesgo de reincidencia de la violencia a largo plazo. Esta información también es útil para establecer los criterios de inclusión de los agresores en dichos programas y para evaluar su efectividad. Igualmente, los resultados de este estudio, junto con las variables de personalidad y psicosociales de estudios previos, se podrían utilizar como herramienta complementaria en el proceso judicial de los agresores, como guía para la evaluación del posible riesgo de reincidencia. Por lo tanto, es fundamental continuar investigando el rol del consumo de alcohol en el funcionamiento neuropsicológico y psicofisiológico de los agresores, así como de los factores protectores ante la violencia contra la mujer. Esta línea de investigación, junto con las contribuciones de la psicología social y de la personalidad, contribuirá en la reducción de la incidencia y la reincidencia de este grave problema social.

Conclusiones

A continuación, se detallan las principales conclusiones de la presente tesis doctoral:

- Los hombres penados por violencia contra la mujer, especialmente aquellos con alto consumo de alcohol, presentaron una mayor alteración cognitiva en comparación con los hombres no violentos con bajo consumo de alcohol. Concretamente, un mayor déficit de las funciones ejecutivas, la atención alternante, la memoria y la empatía.
- El consumo de alcohol se relacionó con una menor flexibilidad cognitiva en los agresores. Además, los agresores con menor flexibilidad cognitiva presentaron menor empatía cognitiva, mayor sexismo hostil, mayor rasgo y expresión de la ira, y una menor percepción de gravedad de sus actos violentos.
- Los hombres alcohólicos abstinentes mostraron mayores déficits neuropsicológicos en comparación con los controles no alcohólicos, concretamente, en funciones ejecutivas, atención sostenida y memoria. No obstante, no se encontraron diferencias en las habilidades empáticas.
- Los agresores con alto consumo de alcohol presentaron una menor activación simpática y una mayor regulación vagal en respuesta al estrés que los agresores con bajo consumo de alcohol.
- Los hombres AA mostraron un afecto negativo más alto y una menor activación parasimpática en respuesta al estrés en comparación con los controles no alcohólicos.

APPENDIX

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To: Moya-Albiol Luis

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Sincerely and best regards,

Dr. David Lovinger

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Differential cognitive profiles of intimate partner violence perpetrators based on alcohol consumption

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ABSTRACT

Despite extensive evidence of heterogeneity in intimate partner violence (IPV) perpetrator profiles, there has been little research into neuropsychological deficits that might help us understand differences within this violent population. Moreover, studies on this topic have not paid much attention to the role of alcohol abuse in neuropsychological domains of IPV perpetrators. Hence, the current study was designed to examine neuropsychological differences among individuals who have committed domestic violence with high ($n = 28$, HA) and low ($n = 35$, LA) levels of alcohol consumption, and non-violent individuals ($n = 37$) to establish differential neuropsychological profiles. An exhaustive neuropsychological assessment battery was employed which combined the computer-based Cambridge Neuropsychological Test Automated Battery with pencil-and-paper measures. Compared to controls, HA IPV perpetrators had slower processing speed and significantly more impairments in attentional set-shifting or switch attention, working and long-term memory, cognitive flexibility, planning, decision-making, emotion decoding skills, and perspective taking. Furthermore, there were differences between IPV perpetrator subgroups in attentional set-shifting or switch attention and cognitive empathy, with HA IPV perpetrators displaying more severe impairments in both cognitive domains than LA IPV perpetrators. Finally, the LA IPV perpetrators had significantly more impairments in working and long-term memory, executive functioning, and emotion decoding skills than controls, but they did not differ in processing speed, attentional set-shifting or switch attention, decision making, or perspective taking. Thus, the current findings suggest that IPV perpetrators with neuropsychological difficulties, especially those who are heavy drinkers, may have the greatest need for cognitive interventions. These cognitive deficits could be employed as targets for developing specific cognitive rehabilitation programs adjuvant to psychotherapeutic intervention for IPV perpetrators.

Introduction

Intimate partner violence (IPV) represents a major public health challenge around the world. According to summary statistics compiled by the World Health Organization (WHO, 2016), about 35% of women in the world have suffered physical and/or sexual partner violence at some point in their life, and 38% of murders of women that occur in the world are committed by a male intimate partner. It has found a positive association between alcohol consumption, especially at hazardous levels, and IPV (Cafferky, Mendez, Anderson, & Stith, 2018; Foran & O'Leary, 2008; Langenderfer, 2013). Specifically, IPV perpetrators are five times more likely than non-perpetrators to consume alcohol (Luthra & Gidycz, 2006; WHO, 2016), and men with alcohol problems are generally more likely to commit violence against their intimate partners (Catalá-Miñana et al., 2017; Crane, Godleski, Przybyla, Schlauch, & Testa, 2016; Easton & Crane, 2016; Klostermann & Fals-Stewart, 2006). Moreover, IPV perpetrators who are starting alcohol abuse treatment are known to be a high-risk group for violence and IPV recidivism (Duke, Giancola, Morris, Holt, & Gunn, 2011; Eckhardt, Parrott, & Sprunger, 2015; Lila, Gracia, & Catalá-Miñana, 2017; Lila, Gracia, Catalá-Miñana, Santirso, & Romero-Martínez, 2016; Romero-Martínez, Lila, Martínez, Pedrón-Rico, & Moya-Albiol, 2016; WHO, 2016). Hence, alcohol consumption could be considered a major contributor to the occurrence of IPV.

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Empirical literature regarding the neuropsychological status of IPV perpetrators is extremely limited. Specifically, despite extensive evidence of heterogeneity in IPV perpetrator profiles, there has been notably little research into neuropsychological deficits that might help us understand differences within this violent population. A systematic review established that compared to non-violent men, IPV perpetrators have executive dysfunction, low levels of cognitive flexibility, inhibition, processing speed, verbal and attention skills, abstract reasoning, cognitive empathy and emotion decoding skills, and working and long-term memory impairments (Romero-Martínez & Moya-Albiol, 2013). Moreover, executive dysfunctions have been associated with impulsivity and disinhibition, especially when individuals present a chronic hazardous alcohol use. In fact, alcohol consumption will lead to a decrease in behavioral control, producing deficits in executive controls after sustained alcohol use, increasing the likelihood to adopt risky behaviors and to search for extreme sensations without considering the future consequences of their behavior (Kravitz et al., 2015; Oscar-Berman & Marinković, 2007; Staples & Mandyam, 2016).

Further, previous studies have not paid much attention to the role of alcohol abuse in the cognition of IPV perpetrators. Indeed, only a few studies have analyzed the role of alcohol abuse in IPV perpetrators' cognitive skills. Alcohol abuse could impair several cognitive domains that underlie IPV, such as cognitive functioning, cognitive empathy, and emotion decoding skills (Beck & Heinz, 2013; Heinz, Beck, Meyer-Lindenberg, Sterzer, & Heinz, 2011; Romero-Martínez, Lila, Catalá-Miñana, Williams, & Moya-Albiol, 2013; Romero-Martínez et al., 2016; Romero-Martínez, Lila, Sariñana-González, González-Bono, & Moya-Albiol, 2013). Several models have been proposed to explain alcohol-related violence as a result of interference in cognitive and emotional skills. One hypothesis, known as the Alcohol Myopia Model (Steele & Josephs, 1990), states that drinking is associated with IPV because alcohol consumption produces a "myopic" effect, deteriorating the cognitive process of attention and facilitating violence by focusing on salient signals that trigger reactions in hostile situations, rather than on less salient ones (Bayless & Harvey, 2017; Giancola, Duke, & Ritz, 2011; Giancola, Josephs, Dewall, & Gunn, 2009; Giancola, Josephs, Parrott, & Duke, 2010). Knowledge of deficits in these cognitive and affective domains could be used to guide the development of early cognitive and affective training initiatives seeking to improve the affected domains and, in turn, reduce the rate of recidivism.

The current study was designed to examine neuropsychological differences between individuals with different levels of alcohol consumption who have committed domestic violence and non-violent individuals (control group), to establish differential neuropsychological profiles. In the light of previous findings regarding neuropsychological differences between IPV perpetrators and non-violent individuals, we hypothesized that IPV perpetrators would manifest more extensive neurocognitive dysfunction, specifically more impairments in attention, memory, executive function, cognitive flexibility, planning, decision-making, emotion decoding skills, and perspective taking, than non-violent individuals Romero-Martínez & Moya-Albiol, 2013). Moreover, evidence suggests that people with histories of heavy or problem drinking are either predisposed to violence or that such chronic use causes or exacerbates cognitive and emotional deficits associated with violence (Beck & Heinz, 2013; Beck, Heinz, & Heinz, 2014; Heinz et al., 2011). Hence, we expected that IPV perpetrators with problem drinking would have more extensive and severe cognitive impairments than the other groups. The analysis of these variables and their relationships may improve our understanding of the role of alcohol abuse in the relationship between neuropsychological deficits and the facilitation and maintenance of IPV. Our findings may also make it possible to tailor treatment for IPV perpetrators and contribute to the development of programs to enhance neuropsychological functioning as an adjunct to psychoeducational and community psychological therapies.

Materials and methods

Participants

The final sample was composed of 100 men who participated voluntarily in the study: 28 IPV perpetrators with high alcohol consumption, 35 IPV perpetrators with low alcohol consumption, and 37 individuals with no history of violence, as the control group. Two IPV perpetrators were excluded from the study because they presented psychopathological signs. All participating IPV perpetrators were recruited from the community psychological and psychoeducational treatment program, *CONTEXTO*, at the Department of Social Psychology of the University of Valencia (Spain). This is a court-mandated program for men sentenced to less than 2 years in prison for violence against women in intimate relationships who had no previous criminal record, and therefore, received a suspended sentence on condition that they attend this type of intervention program (Lila, Gracia, & Herrero, 2012; Lila, Oliver, Catalá-Miñana, & Conchell, 2014; Lila, Oliver, Galiana, & Gracia, 2013). Requirements for participating included: having being sentenced to prison for IPV; not having been convicted for assault outside the home; and not being diagnosed with any mental illness. All the IPV perpetrators who were candidate participants were interviewed by trained researchers (with extensive experience treating IPV perpetrators) to assess their mental health. Cohen's kappa, used to assess inter-rater agreement between qualitative interviewers in the nine psychopathological dimensions evaluated (the same dimensions as the Symptom Checklist 90-R, SCL-90-R, González de Rivera et al., 1989), ranged from .67 to .84. Regardless of the SCL-90-R scores, the interviewees were considered not to have any psychopathological signs and symptoms if they scored less than the mean for their age for each dimension. They were then considered eligible to participate if the qualitative interviews and SCL-90-R scores confirmed they were free of mental illness.

High alcohol consumption was operationally defined as alcohol intake higher than 30 g/day (Cao, Willett, Rimm, Stampfer, & Giovannucci, 2015; Cho, Lee, Rimm, Fuchs, & Giovannucci, 2012; Scoccianti et al., 2016). IPV perpetrators who reported >32 g/day of alcohol intake and presented four or more symptoms of Alcohol Use Disorder (AUD) listed in the DSM-5 were assigned to the high alcohol consumption (HA) group. Conversely, IPV perpetrators who reported intakes lower than 25 g/day and presented fewer than two DSM-5 symptoms for AUD were included in the low alcohol consumption (LA) group. Those IPV perpetrators abstinent for one year were rejected.

Controls were recruited by mailings and advertisements. Inclusion criteria were that they had similar socio-demographic characteristics to the experimental groups, alcohol consumption lower than 30 g/day, and fewer than two DSM-5 symptoms of AUD, as well as a criminal record certificate demonstrating that they had no history of violence.

All participants were right-handed and healthy, lived in Valencia (Spain), were properly informed about the research protocol, and gave written informed consent. The research was conducted taking into account current ethical and legal guidelines on the protection of personal data and research with human beings in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of the University of Valencia (H1348835571691).

Procedure

All participants attended three consecutive sessions at the Faculty of Psychology of the University of Valencia. In the first session, participants were interviewed to exclude those with organic diseases, and socio-demographic data were collected through a semi-structured interview. Then, participants were asked about their consumption of alcohol and cigarettes, in terms of both the amount consumed and how long they had been abstinent. Subsequently, they completed an inventory based on DSM-5 to check for the presence of AUD, and the Fragerström Test of Nicotine Dependence to assess addiction level. Lastly, they were asked whether they had a history of traumatic brain injury, noting whether they had lost consciousness during the trauma; for example, had they been involved in fights, and if so, how often this had resulted in head injuries and had they had blackouts after these injuries?

In the second session, a range of neuropsychological variables was assessed using traditional tests and also the computer-based Cambridge Neuropsychological Test Automated Battery (CANTAB). Executive functions, including cognitive flexibility, planning and decision making, were assessed with the Wisconsin Card Sorting Test (WCST), Zoo test, Key test, One Touch Stockings of Cambridge (OTS) and Cambridge Gambling Task (CGT), attention with the Attention Switching Task (AST) and Rapid Visual Information Processing (RVP), memory with the Word List, Logical Memory, Digit Span, Letter-Number Sequencing, Spatial Span subscales of the Wechsler Memory Scale (WMS-III), and the Rey-Osterrieth Complex Figure (ROCF) test. In addition, emotion-decoding skills were assessed with Reading the Mind in the Eyes test (Eyes Test).

In the third session, psychological variables were assessed. Participants' levels of hostile and benevolent sexism were assessed with the Ambivalent Sexism Inventory (ASI), behaviors related to frontal dysfunction were assessed with the Frontal Systems Behavior Scale, empathy was assessed with the Interpersonal Reactivity Index (IRI), and finally, the type of relationship they had with their partners was assessed with the Conflict Tactics Scales 2 (CTS2).

The end of the assessment was marked by displaying a sign saying, "Thank you very much"; participants were paid €50 for their participation, and were told they could leave.

Frontal behavior

The Spanish version of the *Frontal Systems Behavior Scale (FrSBe)* (Caracuel et al., 2012) was used for this study. This psychometric instrument is used to evaluate non-cognitive changes in behavior and provides a brief, reliable, and valid measure of three frontally based behavioral syndromes: apathy, disinhibition, and executive dysfunction. The FrSBe is a 46-item scale that is easy and relatively quick to administer (taking approximately 10 min). Each item is rated on a 5-point Likert scale. The Executive Dysfunctions subscale of the Spanish version (*FrSBe-Sp*) was used for this study. Cronbach's alpha was 0.84.

Ambivalent sexism

The Spanish version of the *Ambivalent Sexism Inventory (ASI)* was used to evaluate hostile and benevolent sexism (Cárdenas, Lay, González, Calderón, & Alegría, 2010; Expósito, Moya, & Glick, 1998). Participants are asked to rate 22 items on a 5-point Likert scale (0 = strongly disagree; 5 = strongly), with the score ranging from 0 to 55 for each subscale (total score range: 0–110). Higher scores on these scales indicate higher sexism. The reliability coefficient was 0.91.

Conflict tactic measures

Revised Conflict Tactics Scales (CTS2) (Straus, 1979, 1990a) is a self-report inventory to assess how individuals choose to resolve relationship conflicts. Participants report on the behaviors of themselves and their partners during conflict. The measure consists of 78 items, 8-point Likert-type, where 0 means "This has never happened" and 6 means "More than 20 times in the past year". However, 7 means "Not in the past year, but it happened before" (Straus, 1990b). Cronbach's alpha was 0.92.

Attention

Attention Switching Task (AST) measures an individual's ability to switch attention between the direction of an arrow and its location on the screen and to avoid distracting events. It is a highly cognitively demanding test as participants need to switch their attention between congruent (e.g., arrow on the right side of the screen pointing to the right) and incongruent (e.g., arrow on the right side of the screen pointing to the left) stimuli. Dependent variables considered in this study were switch cost, percentage of correct responses, and congruency cost (Cambridge Cognition Ltd., 2012).

Rapid Visual Information Processing (RVP) measures sustained attention. For this test, a white box appears in the center of the computer screen, inside which digits, from 2 to 9, are presented in a pseudo-random order. Participants should detect specific target sequences of three consecutive digits (e.g., 2, 4, 6; 3, 5, 7; or 4, 6, 8). The dependent variable considered in this study was target sensitivity (Cambridge Cognition Ltd., 2012).

Memory

Word List is a subscale of the *Wechsler Memory Scale* (WMS) -III (Wechsler, 2013). Participants are asked to recall a list of words presented five times, and each time, they have to repeat the maximum number of words that they can recall. Moreover, there is an interference list. We considered the three test conditions: immediate recall, delayed recall, and recognition.

Rey-Osterrieth Complex Figure Test assesses visuospatial constructional ability and visual memory. Again, we considered all three test conditions: copy, immediate recall, and delayed recall. Initially, participants must copy a stimulus card. Afterward, the card is taken away and they are instructed to draw what they remember of the figure. Finally, participants are asked to draw the same figure again after 30 min (Rey, 1997).

WMS-III *Logical Memory* evaluates short- and long-term memory and recognition of two stories. Participants are asked to remember as many ideas as possible from two stories. We considered the three test conditions: immediate recall, delayed recall, and recognition (Wechsler, 2013).

Digit Span, a subscale of the WMS-III, measures short-term memory, attention, and concentration. Participants are asked to repeat digits in forward and reverse order (Wechsler, 2013). We considered the three test scores: direct order, indirect order, and total score.

Letter-Number Sequencing, another subscale of the WMS-III, measures the ability to simultaneously recall and organize stimuli (working memory). Participants are asked to repeat several series by listing the numbers in ascending order, and then the letters in alphabetical order (e.g., 9-L-2-A; correct response is 2-9-A-L) (Wechsler, 2013). We considered the total number of numbers and letters correctly recalled as dependent variable.

Spatial Span is a subscale of the WMS-III in which participants must copy a series of moves made by the evaluator with increasing difficulty. There are also two parts (forward and reverse order presentation). We considered the three test scores: direct order, indirect order, and total score (Wechsler, 2013).

Executive function

Cognitive flexibility

Wisconsin Card Sorting Test (WCST) assesses the ability to set cognitive strategies in response to environmental changes. This test is made of 4 stimulus cards and 128 response cards, which contain various colors (red, blue, yellow, or green), shapes (circle, cross, star, or triangle) and numbers (1, 2, 3, or 4) (Heaton, Chelune, Talley, Kay, & Curtiss, 2009). Participants are asked to match the response cards to one of the stimulus cards, using cards that they think match. The first classification rule applied was the color; then, after 10 consecutive hits, the evaluator changes to sorting by shape, and then to sorting by number, giving corrective feedback after each card placement, but not telling the participant the rule to follow. The dependent variables used in this test were number of total trials, number of correct trials, total errors, perseverative errors, non-perseverative errors, completed categories, attempts to complete the first category, and failures to maintain the set.

Planning

The *Zoo test* and *Key test* are part of the Behavioral Assessment of Dysexecutive Syndrome (Wilson, Alderman, Burgess, Emslie, & Evans, 1996). The Zoo test assesses participants' ability to formulate and implement a plan and to follow a pre-formulated plan. The total score is based on the successful implementation of the plan (visiting the right places in the minimum number of moves). The *Key test* assesses their ability to plan a strategy to solve a problem (finding a key lost in a field). The total score is based on the strategy planned by participant (searching all the space provided for the test with a logic pattern).

One Touch Stockings of Cambridge (OTS) assesses spatial planning and working memory based upon the Tower of Hanoi test. The participant is shown two displays containing three colored balls. Participants have to move the balls in the lower display to copy the pattern in the upper display. The difficulty level of the problems presented gradually increases. Dependent variables considered are problems solved on first choice, mean choices to correct, mean latency to first choice, and mean latency to correct (Cambridge Cognition Ltd., 2012).

Decision making

Cambridge Gambling Task (CGT) measures decision-making and risk-taking behavior. The participant is presented with a row of 10 boxes across the top of the screen, some red and some blue. At the bottom of the screen, there are rectangles containing the words ‘Red’ and ‘Blue’. Participants are asked to decide whether a yellow token is hidden in a red box or a blue box, while gambling a number of points that are displayed on the screen. Participants can select a proportion of these points, displayed in either rising or falling order, in a second box on the screen, to gamble on their confidence in this judgment. The participant should try to accumulate as many points as possible during the test. The dependent variables used in this test were deliberation time, proportion bet, decision-making quality, and risk taking (Cambridge Cognition Ltd., 2012).

Empathy

Eyes Test measures emotion-decoding abilities, asking participants to identify the emotion that best represents the expression of the eyes in 36 photographs that show the eye region of the face of different men and women by choosing one of a set of four adjectives. The total score, which ranged from 0 to 36 points, is obtained by summing the number of correct answers (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001), a higher score being interpreted as indicative of stronger emotional decoding abilities.

We used the Spanish version of the *Interpersonal Reactivity Index,* which measures empathic response (Mestre, Frías, & Samper, 2004). This index includes four subscales: perspective taking and fantasy (cognitive empathy), and emotional empathic concern and personal distress (emotional empathy). Responses are given on a 5-point Likert scale. The total score ranged from 7 to 35 points in each subscale, and a higher score indicates higher empathic skills. Cronbach's alpha was 0.81.

Data analysis

The Shapiro-Wilk test was used for exploring whether the data were normally distributed. After confirming normality of the data, a univariate ANOVA was used to check for significant differences between the groups in age, body mass index, number of children, and questionnaire scores. In addition, chi-square analyses were performed for categorical variables such as socio-demographic characteristics (nationality, marital status, level of education, employment status, etc.).

Differences between groups in performance in the neuropsychological tests (attention, memory, executive functions, and empathy) were examined by multivariate analyses (MANOVA). Bonferroni adjustments were applied in order to reduce the Type 1 error. For significant results, partial eta-squared was reported as a measure of effect size (η_p^2).

Data analyses were carried out using IBM SPSS Statistics for Windows, Version 22.0 (Armonk, NY, USA). p values <0.05 were considered statistically significant. Average values are reported in tables as mean ± SD.

Results

Sample characteristics

Descriptive characteristics for IPV perpetrators and controls are presented in Table 1. Groups did not differ in anthropometric or socio-demographic variables, age started drinking, duration of active drinking (years), time of alcohol abstinence (months), personal history of traumatic brain injury, or temporary loss of consciousness. For this reason, these variables were not included as covariates in subsequent analysis. Nevertheless, they differed in amount of alcohol consumption, $F(2,97) = 12.78$, $p < .001$, $\eta_p^2 = .25$, $\beta = .99$; self-reported executive dysfunction, $F(2,97) = 3.80$, $p = .027$, $\eta_p^2 = .09$, $\beta = .68$; and disinhibition, $F(2,97) = 4.55$, $p = .014$, $\eta_p^2 = .11$, $\beta = .75$, with HA IPV perpetrators obtaining higher scores than the rest of the groups ($p < .05$). Moreover, a significant effect for group was found in hostile sexism, $F(2,97) = 4.46$, $p = .015$, $\eta_p^2 = .11$, $\beta = .74$; benevolent sexism, $F(2,95) = 12.74$, $p < .001$, $\eta_p^2 = .25$, $\beta = .99$; CTS2 psychological aggression, $F(2,94) = 5.22$, $p = .008$, $\eta_p^2 = .14$, $\beta = .82$; and physical assault, $F(2,94) = 4.95$, $p = .010$, $\eta_p^2 = .12$, $\beta = .80$, with IPV perpetrators (both HA and LA groups) having higher scores in all these scales than controls ($p < .05$ in all cases).

Neuropsychological assessment

Attention and memory

Attention and memory measures for all participants are summarized in Table 2.

Table 1
Mean ± SD of descriptive characteristics for all groups (*$p < .05$).

	IPV perpetrators		Control (N = 37)
	High alcohol (N = 28)	Low alcohol (N = 35)	
Age (years)	40.21 ± 11.90	39.34 ± 9.83	41.75 ± 11.00
BMI (kg/m^2)	22.55 ± 3.77	23.35 ± 4.68	24.10 ± 4.68
Nationality			
Spanish	23 (82%)	28 (80%)	32 (86%)
Latin Americans	2 (7%)	4 (12%)	5 (14%)
Africans	3 (11%)	3 (8%)	0 (0%)
Marital status			
Single	10 (36%)	11 (31.43%)	19 (51.35%)
Married	5 (18%)	9 (25.71%)	14 (37.84%)
Separated/Divorced/Widowed	13 (46%)	15 (42.86%)	4 (10.81%)
Number of children	.80 ± 1.304	1.50 ± 1.732	.81 ± .967
Level of education			
Primary/lower secondary	20 (71.43%)	16 (45.71%)	16 (43.24%)
Upper secondary/vocational training	7 (25%)	17 (48.57%)	17 (45.95%)
University	1 (3.57%)	2 (5.72%)	4 (10.81%)
Employment status			
Employed	12 (42.86%)	16 (45.71%)	17 (45.95%)
Unemployed	16 (57.14%)	19 (54.29%)	20 (54.05%)
Income level			
1800€ − 12,000€	15 (53.57%)	14 (40%)	24 (64.87%)
>12,000€ − 30,000€	12 (42.86%)	16 (45.72%)	11 (29.73%)
>30,000€ − 90,000€	1 (3.57%)	5 (14.28%)	2 (5.40%)
Traumatic brain injury			
Personal history of traumatic brain injury			
Yes	13 (48.14%)	14 (40%)	12 (32.43%)
No	14 (51.85%)	21 (60%)	25 (67.56%)
Temporary loss of consciousness			
Yes	8 (29.36%)	14 (40%)	13 (35.13%)
No	19 (70.37%)	21 (60%)	24 (64.86%)
Alcohol and nicotine consumption			
Age of start alcohol consumption	16.25 ± 2.17	17.27 ± 6.35	17.14 ± 2.95
Time of alcohol consumption (years)	21.83 ± 10.78	17.77 ± 11.64	22.61 ± 10.77
Amount of alcohol consumption*	69.10 ± 85.60	10.17 ± 10.85	4.90 ± 5.04
Time of alcohol abstinence (months)	0.33 ± 0.78	1.44 ± 3.40	0.63 ± 3.21
Cigarettes/day	11.50 ± 8.92	12.33 ± 10.67	9.09 ± 7.07
Fagerstrom test	3.94 ± 2.10	4.00 ± 3.63	3.18 ± 2.71
Frontal behavior test			
Executive dysfunction*	42.96 ± 10.54	36.81 ± 8.08	37.52 ± 7.25
ASI			
Hostile Sexism*	27.75 ± 13.63	27.62 ± 12.15	19.68 ± 11.81
Benevolent Sexism*	33.03 ± 11.35	36.11 ± 11.72	23.17 ± 12.27
CTS-2			
Psychological aggression*	2.92 ± 1.99	3.14 ± 1.97	1.54 ± 1.43
Physical assault*	1.39 ± 1.37	1.14 ± 2.03	.09 ± .38
Criminal records different to IPV			
No	28 (84.85%)	21 (84%)	–
Yes	1 (3.03%)	0 (0%)	–
Yes, but not violence	4 (12.12%)	4 (16%)	–
Time of sentencing (months)	9.81 ± 6.52	11.90 ± 8.89	–

SD: standard deviation; IPV: intimate partner violence; BMI: body mass index; ASI: ambivalent sexism inventory; CTS-2: conflict tactic scale 2.

Attention

A significant group effect was found for AST switch cost and percentage of correct responses. Specifically, the cost of shifting attention to a different stimulus was higher in HA IPV perpetrators than LA IPV perpetrators ($p = .023$) and controls ($p = .008$), while LA IPV perpetrators had a lower percentage of correct responses than controls ($p = .005$). Regarding RVP, HA IPV perpetrators performed less well in detecting the target sequences than controls ($p = .05$).

Memory

For the WMS-III Word List subscale, IPV perpetrators (both HA and LA groups) remembered fewer words than controls ($p < .001$ in all cases). Moreover, LA IPV perpetrators remembered fewer words in the first trial and in the interference list than controls ($p < .001$ and $p = .012$, respectively).

With regard to the ROCF test, HA IPV perpetrators obtained worse scores to copy the figure ($p < .001$), needed more time to copy the figure ($p = .05$), and remembered the figure less well (both short-term and long-term) ($p = .002$ in both cases) than controls. Moreover, LA IPV perpetrators also needed more time to copy the figure and remembered the figure less well (both short-term and long-term) than controls ($p = .008$ and $p = .035$, respectively).

Regarding the Logical Memory subscale, a significant effect of group was found in the first time that text A and text B were read, IPV perpetrators (both groups) remembering fewer units and topics than controls ($p < .05$ in all cases). Moreover, there were also group

Table 2
Mean ± SD of attention and memory tests of all groups (*$p < .05$).

	IPV perpetrators		Controls (N = 37)	ANOVA statistics		
	High alcohol (N = 28)	Low alcohol (N = 35)		$F(2,97)$	p	η_p^2
Attention						
AST						
Switch cost*	−55.90 ± 80.57	−134.42 ± 123.81	−143.56 ± 119.83	5.46	.006	.10
Percentage of correct responses*	86.48 ± 10.96	82.69 ± 20.71	93.47 ± 6.56	5.36	.006	.10
Congruency cost	116.92 ± 91.58	98.50 ± 75.66	94.13 ± 83.32	.62	.535	.01
RVP						
Sensitivity (from .0 to 1.00)*	0.86 ± 0.07	0.88 ± 0.04	0.90 ± 0.07	2.90	.06	.06
Memory						
Word lists test						
Total words recalled*	30.75 ± 5.86	31.17 ± 4.76	35.05 ± 4.78	7.47	.001	.13
Short-term memory	7.46 ± 2.56	7.48 ± 2.11	8.45 ± 1.93	2.35	.101	.05
Long-term memory	7.46 ± 2.63	7.37 ± 2.43	7.89 ± 2.07	.48	.615	.01
First trial*	5.42 ± 1.89	5.08 ± 1.22	6.05 ± 1.37	3.90	.023	.08
Learning curve	3.85 ± 1.62	4.74 ± 1.55	4.59 ± 1.58	2.69	.073	.05
Interference list*	4.71 ± 1.48	4.25 ± 1.52	5.35 ± 1.67	4.41	.015	.08
Omission	1.78 ± 1.64	2.31 ± 1.49	2.08 ± 1.21	1.04	.345	.02
Recognition	22.32 ± 1.94	22.91 ± 1.37	23.08 ± 1.49	1.91	.153	.03
Rey figure						
Copy score*	32.80 ± 3.87	34.54 ± 2.39	35.41 ± 1.04	8.30	<.001	.15
Copy time*	156.83 ± 73.38	163.30 ± 73.43	118.51 ± 44.77	5.03	.008	.09
Short-term memory score*	20.02 ± 6.16	20.91 ± 6.16	25.38 ± 6.05	7.51	.001	.13
Short-term memory time	117.15 ± 49.63	134.05 ± 52.24	111.92 ± 45.59	1.95	.148	.04
Long-term memory score*	19.13 ± 6.50	20.93 ± 5.69	24.70 ± 6.46	6.96	.001	.13
Long-term memory time	93.45 ± 44.65	108.85 ± 54.45	95.13 ± 32.58	1.20	.304	.02
Logical memory test						
Immediate recall:						
Total score on the first try*	21.93 ± 10.09	21.09 ± 7.92	27.35 ± 6.82	6.05	.003	.11
Text A						
Units*	11.68 ± 5.18	11.40 ± 4.25	14.16 ± 3.82	4.24	.017	.08
Topics*	3.96 ± 1.75	4.31 ± 1.89	5.43 ± 1.21	7.47	.001	.13
Texts B						
Units*	10.25 ± 5.31	9.69 ± 4.44	13.19 ± 3.72	6.31	.003	.12
Topics*	3.82 ± 1.86	4.06 ± 1.66	5.68 ± 1.10	14.64	<.001	.23
Delayed recall:						
Text A						
Units*	8.07 ± 6.07	9.32 ± 5.02	10.92 ± 3.77	2.70	.050	.05
Topics*	3.21 ± 2.23	3.50 ± 1.92	5.38 ± 1.40	13.85	<.001	.22
Texts B						
Units*	13.29 ± 6.42	13.06 ± 4.75	16.62 ± 4.94	4.91	.009	.09
Topics*	4.79 ± 1.61	4.83 ± 1.50	5.97 ± 1.25	7.48	.001	.13
Recognition*	23.39 ± 3.21	23.88 ± 3.44	25.97 ± 4.93	3.96	.022	.08
Digits						
Direct order	7.78 ± 1.82	8.20 ± 2.16	9.05 ± 2.76	2.54	.084	.05
Inverse order*	5.67 ± 1.96	5.91 ± 2.17	7.03 ± 2.16	3.96	.022	.90
Total score*	13.44 ± 3.19	14.11 ± 3.52	16.08 ± 4.51	4.23	.017	.08
Letters and numbers						
Total score*	7.26 ± 2.47	7.91 ± 3.23	10.97 ± 2.67	16.54	<.001	.26
Spatial location						
Direct order	8.85 ± 1.35	8.83 ± 2.05	9.32 ± 1.76	.868	.423	.02
Inverse order*	6.56 ± 2.29	6.82 ± 2.54	8.49 ± 2.16	6.78	.002	.13
Total score*	15.41 ± 3.28	15.52 ± 4.00	17.81 ± 3.35	4.94	.009	.10

SD: standard deviation; IPV: intimate partner violence; AST: attention switching task; RVP: rapid visual processing.

effects for delayed recalled of text A and B; IPV perpetrators (both HA and LA groups) obtained worse scores, meaning that they remembered both texts less well than controls ($p < .05$ in all cases). Further, the HA group had lower scores than controls in the recognition task ($p = .035$).

In the Digits Span subscale, HA IPV perpetrators remembered fewer digits than controls, especially in inverse order ($p < .05$ in all cases). Similarly, regarding the Letter-Number Sequencing subscale, IPV perpetrators (both groups) remembered fewer letters and numbers than controls ($p < .001$ in all cases).

With regard to the Spatial Span subscale, group proved to be significant in inverse order and total score, with IPV perpetrators (both groups) being less able to repeat the series of movements made by the evaluator than controls ($p < .05$ in all cases). However, there were no significant differences between groups in direct order Spatial Span score.

Executive functions and empathic skills

Executive functions and empathic skills measures for all participants are summarized in Table 3.

Cognitive flexibility

A significant group effect was found for some WCST scales; both HA and LA IPV men needed more trials, made more errors, completed fewer categories, needed more trials to complete the first category, and more often failed to maintain the set than controls ($p < .001$ in all cases). Nevertheless, groups did not differ in correct trials.

Planning

Regarding the Zoo test, in version 1 and 2, HA IPV perpetrators spent more time planning, made more mistakes, and obtained worse scores than controls ($p < .05$ in all cases), which means that they had more problems developing logical strategies and executing complex predetermined plans than controls. In total scores of the Zoo test, both groups of IPV perpetrators had lower scores than controls ($p < .05$ in all cases).

There was a significant group effect for the total score on the Key test; both groups of IPV perpetrators were less able to plan a strategy to solve a problem than controls ($p < .001$ and $p = .007$, respectively). Nonetheless, no significant differences were found between groups in planning and execution time.

A significant group effect was found in the OTS problems solved on the first choice and in mean choices to correct in the third, fourth, fifth, and sixth movements to correct. Both groups of IPV perpetrators required more movements to finish the exercises and achieved less good performance than controls ($p < .05$ in all cases). Nonetheless, there were no significant differences in trials that only required one or two movements. Finally, a group effect was also found for latency to first choice and latency to finish exercises correctly in exercises that need one movement. Specifically, LA IPV perpetrators took more time to do the movements than controls ($p < .001$ in all cases).

Decision making

Regarding the CGT, HA IPV perpetrators bet a higher proportion and took on more risk in their decisions than controls ($p = .024$ and $p = .019$, respectively).

Empathy

A significant group effect was found in the IRI Perspective Taking subscale, with HA IPV perpetrators presenting lower scores than LA IPV perpetrators ($p = .048$) and controls ($p = .016$). Nonetheless, groups did not differ in fantasy, empathic concern, or personal distress. With regard to the Eye test, group proved to be significant; IPV perpetrators (both HA and LA groups) obtained lower scores than controls ($p < .001$ in all cases).

Discussion

We examined neuropsychological differences between IPV perpetrators with high and low alcohol consumption and compared these groups to matched controls who were not heavy drinkers and had no history of violence. Compared to controls, HA IPV perpetrators had lower processing speed and significantly more impairments in shift attention, working and long-term memory, cognitive flexibility, planning, decision-making, perspective taking, and emotion decoding skills. Furthermore, there were differences between subgroups of IPV perpetrators in shift attention and cognitive empathy, with those who were heavy drinkers (the HA IPV group) displaying more severe impairments in both cognitive domains than those who were not (the LA IPV group). In addition, the LA IPV perpetrators had significantly more impairments on working and long-term memory, executive functioning, and emotion decoding skills than the controls, though they did not differ from the controls in processing speed, shift attention, decision making, or cognitive empathy.

It has been postulated that violence is related to both alcohol use, and cognitive and emotional functioning (Beck & Heinz, 2013; Heinz et al., 2011). Our results seem to be in accordance with the Alcohol Myopia Model (Bayless & Harvey, 2017; Giancola et al., 2009, 2010, 2011). In particular, the general finding that the HA IPV perpetrators had more memory, attention, and processing speed impairments than controls may relate to their alcohol abuse. This finding may be an indicator of a higher risk of association between acute alcohol intoxication and the increased aggression among this group of perpetrators. The association between alcohol-related cognitive decline and aggressive behavior following acute alcohol intake may be simply because participants with a history of heavy or problem drinking consume alcohol more often and thus are more frequently intoxicated. Nonetheless, there were only significant differences between the HA IPV and LA IPV perpetrators in shift attention. Hence, the relationship of AUD with severe cognitive and emotional dysfunctions in IPV perpetrators is more complex than has been hypothesized.

Executive dysfunctions have been associated with impulsivity and disinhibition, especially when individuals present a chronic hazardous alcohol use. In fact, alcohol consumption might decrease behavioral control while increasing the predisposition to adopt risky behaviors and to search for extreme sensations with a total disregard for future consequences (Kravitz et al., 2015; Oscar-Berman & Marinković, 2007; Staples & Mandyam, 2016). Our results are congruent with this model, in that HA IPV perpetrators had higher self-reported levels of executive dysfunction and use of aggressive strategies than controls. They also showed problems using negative feedback, suggesting an increased inflexibility to shift focus and a rigid adherence to a particular pattern, which makes it difficult for them to learn from their mistakes. This, in turn, makes it difficult for IPV perpetrators to learn from their mistakes or punishments, increasing the likelihood that they will become violent in a domestic context. Furthermore, as was previously established, low cognitive flexibility could be associated with holding sexist ideas about their partners (Romero-Martínez, Lila, Catalá-Miñana et al., 2013). While good decision making frequently requires a careful assessment of anticipated positive and negative outcomes (Gutnik, Hakimzada, Yoskowitz, & Patel, 2006; Leykin, Roberts, & Derubeis, 2011), HA IPV perpetrators had problems developing logical strategies and they also assumed more risks in their decisions than controls. Notably, LA IPV perpetrators showed less cognitive flexibility and weaker planning skills than controls, but they did not differ from controls in decision making. Moreover, the executive dysfunction observed is relatively similar in IPV perpetrators with different levels of alcohol consumption, underscoring the view that alcohol is not the unique and determinant cause of these deficits.

Similar to the findings of Romero-Martínez, Lila, Sariñana-González et al. (2013) of specific cognitive empathy deficits in IPV perpetrators compared to non-violent men, the current study found different patterns of empathy deficits in IPV perpetrators and in controls. In particular, HA IPV perpetrators showed significantly lower accuracy in emotion recognition and in perspective taking than controls; when compared to LA IPV perpetrators, they performed similarly in emotion recognition and significantly less well in perspective taking. In addition, as previously explained, this marked deficit in identifying emotions and in understanding others' feelings and thoughts observed in IPV perpetrators could be partially explained as a result of impaired abilities to shift attention and slow processing speed (Romero-Martínez, Lila, & Moya-Albiol, 2016a). Moreover, it has been hypothesized that empathic deficits could partially explain why certain individuals engage in risky and

Table 3
Mean ± SD of executive functions and empathy tests scores for all groups (*$p < .05$).

	IPV perpetrators		Control (N = 37)	ANOVA statistics		
	High alcohol (N = 28)	Low alcohol (N = 35)		$F(2,97)$	p	η_p^2
Cognitive flexibility						
WCST						
Total trials*	120.21 ± 17.10	114.26 ± 21.80	92.31 ± 20.76	18.52	<.001	.27
Correct trials	66.00 ± 16.96	67.57 ± 12.79	66.67 ± 8.78	.12	.887	.02
Total errors*	54.21 ± 25.20	46.69 ± 25.30	26.05 ± 21.93	12.75	<.001	.21
Perseverative errors*	25.68 ± 11.47	27.83 ± 17.59	13.67 ± 13.75	9.95	<.001	.17
Non-perseverative errors*	28.54 ± 18.79	19.86 ± 11.81	11.72 ± 10.39	12.49	<.001	.20
Completed categories*	3.43 ± 1.97	3.57 ± 1.88	5.38 ± 1.53	13.39	<.001	.21
Attempts to complete the first category*	22.94 ± 24.24	32.29 ± 39.36	15.87 ± 19.29	2.86	.049	.06
Failure to maintain the set*	0.81 ± 0.92	1.37 ± 1.61	0.26 ± 0.59	9.09	<.001	.16
Planning						
Zoo test						
Zoo version 1						
Planning time	48.36 ± 24.96	63.21 ± 36.86	59.10 ± 25.31	1.95	.148	.04
Execution time*	92.14 ± 82.55	85.12 ± 48.05	57.18 ± 34.59	3.67	.029	.07
Errors*	2.59 ± 2.17	2.12 ± 2.38	1.14 ± 1.20	4.74	.011	.09
Total score version 1*	1.26 ± 3.27	2.68 ± 4.21	3.95 ± 2.76	4.71	.011	.09
Zoo version 2						
Planning time*	43.49 ± 34.29	36.39 ± 23.12	27.70 ± 12.08	3.53	.033	.07
Execution time	54.33 ± 47.64	55.89 ± 47.05	35.88 ± 19.02	2.82	.064	.06
Errors	0.89 ± 1.64	0.97 ± 1.74	0.38 ± 0.68	1.82	.167	.04
Total score version 2*	5.37 ± 3.26	4.91 ± 3.37	6.97 ± 2.00	4.93	.009	.09
Total score zoo test*	6.63 ± 5.47	7.59 ± 6.35	10.92 ± 3.80	6.10	.003	.11
Key test						
Planning time	13.24 ± 11.95	11.15 ± 8.42	15.48 ± 14.72	1.14	.324	.02
Execution time	23.33 ± 12.28	24.69 ± 17.62	33.38 ± 26.54	2.42	.094	.05
Total score*	6.81 ± 3.29	8.65 ± 3.65	11.27 ± 3.54	13.02	<.001	.22
OTS						
Problems solved on first choice*	15.03 ± 3.02	16.00 ± 4.45	18.81 ± 3.02	8.20	.001	.15
Mean choices to correct*	1.71 ± 0.53	1.63 ± 0.46	1.33 ± 0.26	7.44	.001	.13
Problems with:						
1 move	1.17 ± 0.53	1.12 ± 0.22	1.06 ± 0.16	1.00	.371	.02
2 moves	1.25 ± 0.39	1.17 ± 0.42	1.14 ± 0.23	.870	.422	.02
3 moves*	1.42 ± 0.49	1.37 ± 0.46	1.08 ± 0.14	7.45	.001	.13
4 moves*	1.67 ± 0.58	1.60 ± 0.59	1.32 ± 0.43	4.06	.020	.08
5 moves*	1.97 ± 0.84	1.79 ± 0.73	1.54 ± 0.37	3.47	.035	.07
6 move*	2.79 ± 1.15	2.72 ± 1.08	1.86 ± 0.94	8.35	<.001	.15
Mean latency to first choice	14673.62 ± 7265.36	18906.10 ± 11429.33	19947.26 ± 11935.37	2.04	.135	.41
Problems with:						
1 move*	8747.65 ± 3302.95	12087.74 ± 9363.30	6953.63 ± 2882.28	6.51	.002	.12
2 moves	7082.91 ± 22705.63	7825.22 ± 23041.18	6670.26 ± 22939.97	1.43	.243	.03
3 moves	8965.16 ± 4337.98	10427.44 ± 4870.10	10092.10 ± 5970.93	.646	.527	.01
4 moves	14439.84 ± 11311.03	16357.72 ± 9071.56	15015.58 ± 7736.00	.360	.699	.01
5 moves	24721.74 ± 16877.17	26256.96 ± 18742.32	34192.66 ± 24228.45	2.07	.131	.04
6 move	24084.41 ± 17827.82	40481.52 ± 48533.45	46759.33 ± 40024.86	2.72	.071	.05
Mean latency to correct problems with:						
1 move*	9313.49 ± 3694.57	14111.03 ± 11395.22	7178.93 ± 2924.492	8.45	<.001	.15
2 moves	8902.96 ± 3818.69	10136.43 ± 7401.45	7979.25 ± 4535.23	1.35	.264	.03
3 moves	11758.40 ± 8527.88	13884.02 ± 8386.89	10791.31 ± 6104.11	1.51	.225	.03
4 moves	22097.44 ± 24259.04	22477.01 ± 13627.41	19392.81 ± 11787.51	.36	.699	.01
5 moves	35255.63 ± 25785.04	35885.43 ± 23406.45	48376.85 ± 36049.41	2.19	.117	.04
6 moves	39906.75 ± 28624.96	57317.70 ± 51771.00	64303.91 ± 39370.71	2.72	.071	.05
Decision making						
CGT						
Deliberation time	2760.89 ± 853.10	3321.64 ± 2190.06	2545.12 ± 794.51	2.64	.076	.05
Proportion bet*	.62 ± .13	.54 ± .17	.51 ± .18	3.78	.026	.07
Quality of decision making	.84 ± .14	.82 ± .14	.84 ± .15	.20	.819	.01
Risk taking*	.66 ± .13	.58 ± .17	.54 ± .17	3.96	.022	.08
Empathy						
IRI						
Perspective taking*	20.82 ± 4.65	23.74 ± 5.22	23.46 ± 4.20	4.44	.014	.08
Fantasy	16.07 ± 4.91	19.00 ± 4.43	19.27 ± 6.85	3.08	.060	.06

Table 3 (*continued*)

	IPV perpetrators		Control (N = 37)	ANOVA statistics		
	High alcohol (N = 28)	Low alcohol (N = 35)		$F(2,97)$	p	η_p^2
Empathic concern	24.86 ± 3.29	24.94 ± 4.40	26.05 ± 3.60	1.05	.352	.02
Personal distress	13.46 ± 3.85	14.17 ± 5.22	12.00 ± 3.00	2.58	.080	.05
Eye test						
Total score*	17.64 ± 4.42	18.86 ± 4.24	22.77 ± 4.42	13.14	<.001	.21

SD: standard deviation; IPV: intimate partner violence; WCST: Wisconsin Card Sorting Test; OTS: one touch stockings of Cambridge.

antisocial behaviors (van Zonneveld, Platje, de Sonneville, van Goozen, & Swaab, 2017), and this, in turn, could increase the heavy drinking (Dethier & Blairy, 2012; West, Drummond, & Eames, 1990). Nevertheless, the association between these variables (antisocial traits and empathic deficits) could be transactional. Furthermore, antisocial behaviors are considered robust predictors of IPV (Capaldi, Knoble, Shortt, & Kim, 2012) and IPV recidivism (Romero-Martínez, Lila, & Moya-Albiol, 2016b). In this sense, our results suggest that HA IPV perpetrators may be more likely to exhibit antisocial traits and/or behaviors than the rest of participants due to their empathic impairments.

The main limitation of the study is that the sample sizes were modest, particularly in the HA IPV perpetrator group. For this reason, the findings should be considered preliminary, and further research is needed to explore these patterns in larger samples. Moreover, it is hard to make differential conclusions about the role of alcohol, because both groups of IPV perpetrators presented a similar pattern of neurocognitive deficits. Another limitation of the current study is the use of cross-sectional data rather than longitudinal data, and hence definitive conclusions cannot be drawn regarding the effects of alcohol in IPV perpetrators. Although heavy long-term alcohol users will experience mild to moderate socio-cognitive impairments (Le Berre, Fama, & Sullivan, 2017), there are also numerous socio-cognitive impairments associated with acute alcohol intoxication (Dry, Burns, Nettelbeck, Farquharson, & White, 2012). Thus, it is difficult to differentiate between long-term effects of alcohol abuse on cognition from acute effects of intoxication and their interactions. Further, it would be useful to analyze how particular personality traits (such as antisocial personality) would predict the neuropsychological deficits presented in our study. Another limitation is the absence of a non-violent alcoholic control group. Although we initially collected inpatients from an alcohol abuse clinic, the majority of those who participated in our study were in an abstinence period higher than 8 months. However, IPV perpetrators who participated in our study actively consume alcohol. For this reason, these groups were not directly comparable. Moreover, it should be mentioned that IPV perpetrators who participated in our study did not suffer from any mental illness and had no previous criminal record, which could indicate that these participants presented less severe violence than typical IPV arrestees, and they are only men. Hence, future studies should consider analyzing neuropsychological deficits in different IPV perpetrator subgroups. Finally, we did not employ the same classification criteria as in previous studies (Romero-Martínez, Lila, Catalá-Miñana et al., 2013; Romero-Martínez et al., 2016; Romero-Martínez, Lila, Sariñana-González et al., 2013). Specifically, previously, the Alcohol Use Disorders Identification Test (AUDIT) (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001) scores were used to screen for alcohol misuse, while in this new research, we classified groups based on alcohol intake and DSM-5 diagnostic criteria for AUD. Thus, it is important to note the need to homogenize the criterion of classification of the groups of IPV perpetrators across studies in order to extend the external validity of results.

On the other hand, this study has a number of strengths. First, our data are novel, in that no previous studies have examined neuropsychological functioning with an established neuropsychological battery among different types of IPV perpetrators and matched controls. Thus, our findings could be considered for developing specific cognitive rehabilitation programs adjuvant to the psychotherapeutic intervention for IPV perpetrators. Second, in relation to methodology, we combined a rapid exhaustive computer-based neuropsychological assessment battery with pencil-and-paper measures. This study is part of an ongoing research effort to improve our understanding of the reasons why IPV perpetrators use violence against their partners. Thus, future research should aim to provide a more nuanced look at the role of neuropsychological functioning in IPV, as well as protective factors that prevent other men with poor neuropsychological functioning from engaging in IPV.

Conclusions

The current findings have important implications for prevention and treatment. Regarding preventive practice, analysis of executive functions and impulsivity may prove useful in detecting individuals at high risk for IPV, and should be further investigated within the context of early screening and risk prediction. With respect to treatment, many interventions for IPV perpetrators rely on changes in cognition and behavior that may be very difficult for individuals with subtle cognitive and emotional impairments to implement effectively. For example, individuals with low cognitive flexibility may have considerable difficulty considering alternative interpretations or implementing alternative responses in the context of an angry reaction to an intimate partner. Moreover, they also may have difficulty switching from an unproductive cognitive reaction or behavioral strategy to a more adaptive response, due to perseveration and inflexibility. Hence, the current findings suggest that IPV perpetrators with neuropsychological difficulties, especially those who are heavy drinkers, may have the greatest need for cognitive interventions, but may also face the greatest challenges in implementing cognitive change strategies. Professionals working with IPV perpetrators in a clinical context should consider the potential impact of neuropsychological functioning when tailoring interventions. Nonetheless, IPV perpetrators represent a very heterogeneous group, and clinicians should understand that problems with neuropsychological functioning do not account for all abusive behavior or anger difficulties.

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Disclosure statement

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The Role of Mental Rigidity and Alcohol Consumption Interaction on Intimate Partner Violence: A Spanish Study

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ABSTRACT

Intimate partner violence (IPV) has often been linked to alcohol consumption. Alcohol abuse affects cognitive processing through its effects on the prefrontal cortex, generating influence in mental rigidity (MR). This study analyzes the influence of MR as a predisposing factor to violence. The sample consisted of 136 men with a history of IPV. Participants with high MR had lower empathy and perception of the severity of IPV, and higher alcohol consumption and hostile sexism than participants with lower MR. These results should be considered in the development of prevention and intervention programs with the goal of increasing their effectiveness.

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Intimate partner violence (IPV) is a serious public health problem worldwide. It is estimated that 35% of women have experienced dating violence or sexual violence by others at some point in their life, and as many as 38% of murders of women are committed by their own partners (World Health Organization [WHO], 2013). This type of violence causes serious physical, psychological, sexual, and reproductive health problems in victims (Martínez, Sánchez, & Blasco, 2010). As reported, it has high economic and social costs in Western societies (WHO, 2013).

Cognitive deficits mostly related to neurological alterations increase proneness to violence (Pinto et al., 2010; Teichner, Golden, van Hasselt, & Peterson, 2001). In particular, dysfunctions in the prefrontal cortex facilitate aggression and violence (Becerra-García, 2015; Koenings et al., 2007; López-Caneda et al., 2014; Moya-Albiol, 2010; Walling, Meehan, Marshall, Holtzworth-Munroe, & Taft, 2012). The prefrontal cortex is mainly responsible for executive functions, which are usually associated with behavioral regulation and social adjustment. They include several cognitive processes required to orient behavior toward a goal, such as decision making, abstract thinking, and formulation and execution of plans, as well as mental rigidity (Buller, 2010). Mental rigidity has an important role adjusting behavior

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under conditions of changing environmental demands (Grant & Berg, 1948; Teichner et al., 2001). Thus, high mental rigidity indicates a lack of flexibility in self-regulated behavior. Moreover, the mental rigidity has been defined in the Wisconsin card sorting test (WCST) as a difficulty in using the negative feedback productively suggesting a rigid adherence to a specific pattern and a decreased ability to shift focus (Heaton, Chelune, Talley, Kay, & Curtiss, 2009; Romine et al., 2004; Steinglass, Walsh, & Stern, 2006). This, in turn, makes it difficult for IPV perpetrators to learn from their mistakes or punishments, increasing the risk of recidivism (Heinz, Beck, Meyer-Lindenberg, Sterzer, & Heinz, 2011; Romero-Martínez, Lila, Catalá-Miñana, Williams, & Moya-Albiol, 2013a; Teichner et al., 2001).

Mental rigidity has been negatively related to both cognitive and emotional empathy (Thoma et al., 2011). Consistent with this, high mental rigidity may lead to greater difficulties with emotional empathy as men with high mental rigidity show impairment in emotional decoding abilities (Romero-Martínez, Lila, Martínez, Pedrón-Rico, & Moya-Albiol, 2016; Thoma, Friedmann, & Suchan, 2013). This deficit could generate misunderstandings, giving a negative connotation to the intentions or feelings of their partners and promoting inappropriate reactions, anger expression, or violent behavior in stressful or tense situations. In this regard, previous studies have pointed out that stronger feelings of anger alter normal cognitive processes in ways that would increase levels of sympathetic arousal and otherwise motivate aggressive behaviors (Houston, 1994).

Moreover, men with higher mental rigidity and empathy deficits habitually hold stereotypes and sexist ideologies that resist change, appearing as hostile sexism in the case of IPV perpetrators (Romero-Martínez et al., 2013a; Teichner et al., 2001). Hostile sexism includes prejudicial attitudes and discriminatory behaviors based on a supposed inferiority of women. This form of prejudice includes intolerance and antipathy that would include the wish for obedience and subordination (Cárdenas, Lay, González, Calderón, & Alegría, 2010; Lila, Gracia, & García, 2013a). In IPV perpetrators, hostile sexism could entail a lower perception of the severity of their actions, given their perception of female inferiority, and a greater tendency to blame the victim, meaning that they feel less sense of personal responsibility (Gracia, García, & Lila, 2011; Gracia & Herrero, 2006; Gracia & Tomás, 2014; Lila et al., 2013a).

Other factors could modulate the relationship between mental rigidity and violence, alcohol consumption being one of the most studied (Eckhardt, Parrott, & Sprunger, 2015). Alcohol acts as a depressor of the central nervous system, mainly by inhibiting the functioning of the prefrontal cortex. Namely, in chronic alcohol consumers the effects of alcohol could alter the normal functioning of cognitive processes required to adjust behavior (López-Caneda et al., 2014; Romero-Martínez et al., 2013a). Although there is not a direct causal relation between alcohol and violence, a high proportion of IPV perpetrators present with frequent alcohol consumption and/or commit violent acts under the influence of alcohol (López-Caneda et al., 2014).

The main aim of this study was to assess cognitive differences between IPV perpetrators with low and high mental rigidity, using socio-cognitive variables that could be related to a higher predisposition to violence. We hypothesized that men with a low level of mental rigidity would present more cognitive empathy (Thoma et al., 2011), less hostile sexism (Romero-Martínez, Lila, Sariñana-González, González-Bono, & Moya-Albiol, 2013b; Teichner et al., 2001) and lower trait anger and levels of anger expression (Romero-Martínez et al., 2013b) than men with a high level of mental rigidity, and that the latter would tend to minimise or deny the severity of their violent behavior (Gracia et al., 2011; Lila et al., 2013a). Further, we assessed differences in alcohol consumption among the men with low and high mental rigidity. We expected to find that IPV perpetrators with low levels of mental rigidity would report lower alcohol consumption than those with high levels of mental rigidity (Romero-Martínez et al., 2013a).

Method

Participants

The final sample was composed of 136 IPV perpetrator men who participated voluntarily in the study. Seventy participants were excluded from the analysis because they did not complete the neuropsychological or psychological assessment. All participants were recruited from the community and psychoeducational treatment program, *Contexto*, at the Department of Social Psychology of the University of Valencia (Spain). This is a court-mandated program for men sentenced to less than 2 years in prison for violence against women in intimate relationships. For this reason, participants had their sentence suspended on the condition that they attended an intervention program (Lila, 2013; Lila et al., 2010; Lila, Gracia, & Herrero, 2012; Lila, Oliver, Galiana, & Gracia, 2013b). Requirements for participating included: having being jailed for IPV; not having been convicted for assault outside the home; and not being diagnosed of any mental illness, assessed with the SCL-90-R (González De Rivera et al., 1989). All participants were interviewed by trained researchers (with extensive experience treating IPV perpetrators) to assess their mental health. Candidates were eligible to participate if the qualitative interviews and SCL-90-R scores confirmed they were free of mental illness.

All participants were adult men ages 21–78 years, with a mean age of 43.24 years (*SD* = 10.87), all living in the Valencian region (Spain). Those included in our study did not have a previous criminal record or any physical or mental illness. All participants were properly informed about the research protocol and gave written informed consent. The research was conducted taking into account current ethical and legal guidelines on the protection of personal data and research with human beings in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of the University of Valencia (H1348835571691).

Procedure

Considering the efficiency of the procedure followed in previous studies, and in order to avoid fatigue and interferences among questionnaires (Romero-Martínez et al., 2013a, 2013b, 2014), all participants attended three sessions at the Faculty of Psychology of the University of Valencia before they started the *Contexto* intervention program to minimize possible effects of fatigue later in the day. In the first session, participants were interviewed to exclude those with organic diseases (SCL-90-R) and socio-demographic data were collected through a semi-structured interview. In addition, alcohol consumption was assessed using the Spanish versions of the Alcohol Use Disorders Identification Test (AUDIT) questionnaire. In the second session, a range of cognitive and psychological variables were assessed, including mental rigidity with the WCST and emotional empathy with the Reading the Mind in the Eyes (Eyes Test) and the Interpersonal Reactivity Index (IRI). In the third session, trait anger and anger expression were evaluated with the State-Trait Anger Expression Inventory-2 (STAXI-2), hostile sexism with the Ambivalent Sexism Inventory (ASI) and perception of violence severity with the Victim-blaming attitudes (VIDO).

Mental rigidity

The WCST evaluates abstract reasoning and the ability to change cognitive strategies in response to environmental changes (mental rigidity). It consists of four stimulus cards and 128 response cards containing various colors (red, blue, yellow, or green), shapes (circle, cross, star, or triangle), and numbers (one, two, three, or four) of figures (Heaton et al., 2009). The participants have to match the response cards to one of the stimulus cards, using cards that they think match. First, the evaluator will apply the color classification rule; then, after 10 consecutive hits, he or she will change to sorting by shape, and then to sorting by number, giving corrective feedback after each card placement, but not telling the participant the rule to follow. The WCST is scored in terms of the number of correct responses and the number of perseverative errors during the test. Participants with more correct responses and lower perseverative errors have been considered less rigid mentally in comparison with those with less correct responses and high number of perseverative errors.

Empathy

The Eyes Test measures emotional decoding. Participants have to identify the emotion that best represents the expression of the eyes in 36 photographs that show the eye region of the face of different men and women. The participants have to choose one of a set of adjectives, and the total score is obtained by summing the number of correct answers (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001). The scores can range from 0 to 36 points. A higher score could be interpreted as a better emotional decoding process.

The IRI (Davis, 1983) assesses the empathic response. It includes four subscales: two for evaluating cognitive empathy (perspective taking and fantasy) and two for emotional empathy (empathic concern and personal distress). Responses are given on a 5-point Likert scale. In this study, we used the Spanish version (Mestre, Frías, & Samper, 2004). Possible scores on this measure range from 7 to 35 points in each subscale; therefore, a higher score has been interpreted as better empathy ability. Reliability coefficients ranging from .55 to .66 and adequate validity (communality analyses > .4, KMO > .5, and Bartlett's sphericity test < .05).

Alcohol consumption

The Spanish version of the AUDIT (Contell-Guillamón, Gual-Solé, & Colom-Farran, 1999) was used to evaluate the quantity and frequency of alcohol use in adults. It has been developed by the WHO to identify when alcohol consumption becomes hazardous or harmful for health. It is composed of 10 self-report items with response options ranging from 0 (never) to 4 (daily or almost daily; Babor & Grant, 1989), possible scores on this measure rage from 0 to 40. In this test, a higher score indicates harmful alcohol consumption to participants' health. Cronbach's alpha was .77 and validity was adequate (communality analyses > .4, KMO > .5, and Bartlett's sphericity test < .05).

Trait anger and anger expression

The STAXI-2 assesses trait anger and its expression (Spielberger, 1999). It is composed of two subscales for evaluating the anger trait (temperament and reaction) and four for anger expression (anger expression out, anger expression in, anger control out, and anger control in). For the present study, responses to these scales were combined into a single variable called Trait Anger (T-Ang). In addition, a general anger expression index (AEI) was calculated by summing the scores on the two expression subscales and subtracting the score on the two control scales, and finally adding 36 units to avoid negative scores. In this study, we used the Spanish version (Miguel-

Tobal, Casado, Cano-Vindel, & Spielberger, 2001). The scores can range from 0 to 72, with high scores showing more anger expression. Psychometric data were adequate in reliability (Cronbach's alpha ranged from .67 to .89) and validity (communality analyses > .4, KMO > .5, and Bartlett's sphericity test < .05).

Sexism

The Spanish version of the ASI was used to evaluate hostile and benevolent sexism (Expósito, Moya, & Glick, 1998). Participants are asked to rate 22 items on a 5-point Likert scale (0 = strongly disagree; 5 = strongly agree), scores can range from 0 to 55 in each subscale (0–110 total scale possible score range). A higher punctuation in these scales indicates a major sexism ideology in participants. Psychometric data were adequate in reliability (Cronbach's alpha were .99 and .86, respectively) and validity (communality analyses > .4, KMO > .5, and Bartlett's sphericity test < .05).

Perception of violence severity

The VIDO questionnaire evaluates the perceived severity of violence (Gracia & Tomás, 2014). Participants are asked to rate eight items concerning different situations of violence against women on a severity scale of 1 to 10. The final score is calculated by summing the scores on all items. The scores can range from 8 to 80, with a high score interpreted as high perceived severity of violence. Psychometric data were adequate in reliability (Cronbach's alpha was .90) and adequate validity (communality analyses > .4, KMO > .5, and Bartlett's sphericity test < .05).

Data analysis

To classify participants as having high or low mental rigidity, K-means clustering was performed employing two of the scores obtained on the WCST: (a) number of attempts and (b) number of perseverative errors. K-means clustering technique allows grouping the participants taking into account variables that characterize them, forming groups with a high degree of internal homogeneity and external heterogeneity. The low mental rigidity (LMR) group (n = 75) was composed of participants who made the smallest number of attempts, scores in this group ranged from 72 to 128 (M = 111.41 ± 21.05), and perseverative errors, scores ranged from 6 to 37 (M = 19.01 ± 10.77). Whereas the high mental rigidity (HMR) group (n = 61) was formed by those who made the most attempts, all participants in this group obtained a score of 128 (M = 128 ± .00) and perseverative errors, scores ranged from 25 to 94 (M = 47.52 ± 18.14).

Data was normally distributed using Kolmogorov-Smirnov statistics ($p > .05$). *t*-Tests were carried out to detect significant differences between groups in quantitative variables as age, empathy, anger trait and expression, ambivalent sexism, and perception of violence severity. Effect sizes for the between-group differences were calculated using Cohen's *d*. Chi square analyses were performed for categorical variables as demographic variables (marital status, level of education, and employment status).

All statistical analyses were performed with the IBM SPSS Statistics for Windows, Version 22.0 with the alpha level set at .05 and a confidence level of 95%.

Results

Descriptive characteristics and neuropsychological measures for all participants are summarized in Table 1. No significant differences were found between IPV perpetrators with LMR and HMR in age, marital status, education level, and employment status.

There were differences among groups in alcohol consumption. LMR participants reported lower alcohol consumption than those categorized as HMR, t (90.591) = 2.261, p = .026, d = .475, P = .94.

Table 1. Mean ± SD of descriptive characteristics and psychological measures for groups with low and high mental rigidity.

	Low mental rigidity (*N* = 75)	High mental rigidity (*N* = 61)
Age (years)	42.25 ± 10.45	44.44 ± 11.33
Marital status		
Married	26 (34.7%)	13 (21.3%)
Single	20 (26.7%)	20 (32.8%)
Separate	7 (9.3%)	8 (13.1%)
Divorced	21 (28%)	20 (32.8%)
Widower	1 (1.3%)	0 (0%)
Level of education		
Primary/lower secondary	41 (54.7%)	40 (65.5%)
Upper secondary/vocational training	28 (37.3%)	17 (27.9%)
University	6 (8%)	4 (6.6%)
Employment status		
Employed	41 (54.7%)	32 (52.5%)
Unemployed	34 (45.3%)	29 (47.5%)
AUDIT*	4.03 + 3.57	6.03 + 6.08
Eye Test**	19.33 ± 3.48	16.95 ± 4.36
IRI perspective taking*	23.16 ± 5.25	21.46 ± 4.28
IRI fantasy	16.61 ± 5.11	16.41 ± 5.13
IRI empathic concern	25.19 ± 4.09	24.10 ± 4.47
IRI personal distress	15.91 ± 4.64	15.82 ± 3.93
STAXI-2 T-Ang*	14.80 ± 3.37	16.39 ± 5.51
STAXI-2 AEI*	22.52 ± 10.23	26.15 ± 11.90
ASI hostile sexism*	26.36 ± 12.80	30.97 ± 14.07
ASI benevolent sexism	33.25 ± 12.68	34.03 ± 13.20
VIDO*	72.44 ± 11.06	66.98 ± 15.52

*p < .05. **p < .001.

Groups differed in Eye Test scores, t (113.659) = −3.462, p = .001, d = .649, P = .99, and in IRI perspective taking, t (134) = −2.036, p = .044, d = .351, P = .87, IPV perpetrators with LMR showing higher empathy than those with HMR.

On the other hand, there were significant differences between groups in trait angers scores, t (95.281) = 1.977, p = .050, d = .405, P = .87, and anger expression scores, t (133) = 1.903, p = .051, d = .330, P = .81. Thus, the LMR group presented lower punctuation in both variables than the HMR group.

Finally, the LMR group obtained lower scores in hostile sexism, t (134) = 1.996, p = .048, d = .344, P = .85, and had a greater perception of violence severity, t (105.219) = −2.309, p = .023, d = .450, P = .94, than the HMR group.

Discussion

As hypothesized, in the present study, IPV perpetrators with LMR had greater empathic abilities and greater perception of the severity of the IPV committed, and lower alcohol consumption, trait anger, anger expression, and hostile sexism than those with HMR. The study's statistical power ranged from 81 to 99, which means that it was adequate to demonstrate our hypotheses.

Perpetrators with LMR showed stronger emotional decoding abilities and this could facilitate the maintenance of appropriate social relationships. Emotional empathy is essential to recognize one's own intentions and feelings and those of others, and to avoid violent behavior in tense situations or conflicts with partners (Romero-Martínez & Moya-Albiol, 2013; Thoma et al., 2013). This relation between violence and empathy is currently being studied from a psychobiological perspective, and some important results indicated that violence and empathy share the same brain structures (Moya-Albiol, 2011). Consequently, the same neuronal circuits could control the capacity to understand the feelings and thoughts of other people and also the capacity to attack them (Moya-Albiol, 2014).

Alcohol consumption modulates the relationship between mental rigidity and IPV (Eckhardt et al., 2015; López-Caneda et al., 2014). In our study, IPV perpetrators with LMR reported lower alcohol consumption than those with HMR. Hence, although alcohol consumption is not a direct causal factor, its effects on the brain could facilitate the perpetration of violence. A previous study analyzed neuropsychological differences between IPV perpetrators with low and high alcohol consumption, and the latter were found to have higher scores in impulsivity, hostile sexism, and trait anger (Romero-Martínez et al., 2013a).

In relation to this, men with less empathy are also those who have higher levels of anger expression. IPV perpetrators with LMR showed lower trait anger and anger expression than those with HMR. Anger has been related to a series of personal features that impair the cognitive process (Houston, 1994). In line with this, previous research found higher trait anger in IPV perpetrators than in a control group (Romero-Martínez et al., 2014). Anger is generally regarded as an affective psychological feature, and it has been related to feelings, such as contempt, resentment, and/or disgust.

According to previous studies (Romero-Martínez et al., 2013a; Teichner et al., 2001), IPV perpetrators with LMR report less hostile sexism than those with HMR. The maintenance of such negative ideologies about women makes abusers dismiss the importance to their acts of violence (Cárdenas et al., 2010). In relation to this, IPV perpetrators with LMR showed a greater perception of the severity of IPV. To recognize IPV as a serious transgression is likely to be a variable that contributes to avoiding the perpetration and recidivism of this kind of violence (Gracia et al., 2011; Gracia & Herrero, 2006; Gracia & Tomás, 2014; Lila et al., 2013a). This could be a very important issue to bear in mind in future intervention programs attempting to minimize violence recidivism.

Although this study represents an advance in our understanding of factors predisposing to IPV, its limitations should be taken into account in interpreting the results and designing future studies. Some variables were assessed using self-report questionnaires, and a high need for social desirability in IPV perpetrators could lead them to provide incorrect answers. Moreover, the sample was composed of IPV perpetrator men who participated voluntarily in the study but is not a random sample. Although we did not find differences between groups in educational level, future studies could analyze the influence of this issue and general intelligence in mental rigidity, due to their importance for executive functions. Moreover, analyzing other psychobiological variables could help to define a more complete perpetrators' profile, which in turn, permits one to explore neurobiological mechanisms involved in IPV. Nevertheless, these variables should be considered complementary to psychological and gender relationship variables.

An increased understanding of IPV may enable the development of prevention and intervention programs based on a more prescriptive, empirically-based approach. Specifically, the understanding of the potential role of psychobiological variables, such as those analyzed in our study, would enable us to develop more adapted and effective prevention and treatment programs for IPV, the establishment of criteria for inclusion in such programs, the identification of differences between IPV perpetrators, leading to the definition of typologies, and also the assessment of the intervention programs effectiveness.

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Agradeciendo el interés y confianza depositados en Adicciones, le envía un cordial saludo,

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Cognitive profile of long-term abstinent alcoholics in comparison with non-alcoholics

Perfil cognitivo de los alcohólicos abstinentes durante un periodo de tiempo prolongado en comparación con un grupo de hombres que no consumen alcohol

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Abstract

Scarce studies have focused on the cognitive profile of chronic alcoholic men after long-term abstinence. Thus, we examined neuropsychological differences between long-term abstinent alcoholics for an average of 3.2 years (n = 40, LTAA; age = 45.55 ± 8.99) and matched for socio-demographic variables with non-alcoholic controls (n = 39; age = 42.05 ± 11.33). To this aim, we employed a neuropsychological assessment battery covered relevant cognitive domains: IQ, memory, attention, executive functions and empathy. LTAA presented deficits in abstract reasoning, speed processing, sustained attention, working and long-term memory (verbal and visuospatial), cognitive flexibility, inhibition and planning. Although our results must be interpreted with caution because of the cross-sectional nature of our study, it may offer a broader knowledge and understanding of alcohol-related socio-cognitive deficits after long-term abstinence. These deficits might entail risk factors for relapse in alcohol consumption, as they may interfere with recording therapeutic advice and internalizing the verbal material presented in rehabilitation programs. In turn, these impair the global efficacy of alcohol-relapse prevention programs. Hence, this knowledge could be applicable in guiding the development of early coadjutant treatments.
Keywords: Abstinence; Alcohol related-cognitive deficits; Alcoholism; Empathy; Neuropsychology.

Resumen

Solo pocos estudios han analizado el perfil cognitivo de los hombres con un trastorno por consumo de alcohol tras un periodo de abstinencia prolongado. Por tanto, este estudio tiene como principal objetivo analizar las diferencias neuropsicológicas entre un grupo de hombres con trastorno por consumo de alcohol pero abstinentes de forma ininterrumpida durante 3,2 años (n = 40, edad = 45,55 ± 8,99) en comparación con un grupo de hombres sin trastorno por consumo de alcohol pero con unas características socio-demográficas similares a las del grupo experimental (n = 39; edad = 42,05 ± 11,33) para establecer diferentes perfiles neuropsicológicos. Empleamos una batería neuropsicológica exhaustiva que evaluó los siguientes dominios cognitivos: CI, memoria, atención, funciones ejecutivas y empatía. El grupo de hombres alcohólicos abstinentes presentaron déficits en razonamiento abstracto, velocidad de procesamiento, atención sostenida, memoria de trabajo y a largo plazo (para información verbal y visuoespacial), flexibilidad cognitiva, y en las capacidades de inhibición y planificación. A pesar de que nuestros resultados deben interpretarse con cautela dado el carácter transversal de nuestro estudio, ofrece información relevante sobre el estado cognitivo de los hombres con un trastorno por consumo de alcohol tras una abstinencia prolongada. Estos déficits podrían estar implicados en las frecuentes recaídas en esta población. Del mismo modo, interferirían en la asimilación de contenidos teóricos de intervenciones psicoterapéuticas, lo que, a su vez, disminuiría la eficacia de las mismas. Por ello, estos resultados deberían ser empleados para el desarrollo de programas de rehabilitación cognitivos coadyuvantes a la psicoterapia.
Palabras clave: Abstinencia; Alcoholismo; Déficits cognitivos; Empatía; Neuropsicología.

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Several studies have demonstrated that long-term chronic alcoholism is associated with potentially long-term deleterious effects on neuropsychological functioning (Le Berre, Fama, & Sullivan, 2017; Stavro, Pelletier, & Potvin, 2013; Valmas, Mosher-Ruiz, Gansler, Sawyer, & Oscar-Berman, 2014), but these deficits depends on variables such as drinking patterns (the amount, type, frequency...), the age of initiation of alcohol; the duration of the hazardous and harmful alcohol consumption and the alcohol abstinence (Bernardin, Maheut-Bosser, & Paille, 2014; Sullivan, Rosenbloom, Lim, & Pfefferbaum, 2000a; Sullivan, Rosenbloom, & Pfefferbaum, 2000b; Rosenbloom, O'Reilly, Sassoon, Sullivan, & Pfefferbaum, 2005). Given that alcoholic cognitive deficits are not evently distributed among individuals, it has been suggested that long-term alcohol abusers vary along of a continuum (Bates, Voelbel, Buckman, Labouvie, & Barry, 2005; Oscar-Berman, Valmas, Sawyer, Ruiz, Luhar, & Gravitz, 2014).

Unfortunately there are several limitations in the study of cognitive function in abstinence. In fact, it remains unclear the time of abstinence needed for normalization of cognitive function and which cognitive domains improve during this period of abstinence (Pelletier, Nalpas, Alarcon, Rigole, & Perney, 2016). Although several studies have shown certain improvements in specific cognitive domains such as visuospatial capacity, memory, and executive function after the first months to one year of abstinence (Alhassoon et al., 2012; Bernardin et al., 2014; Erickson & White, 2009; Oscar-Berman et al., 2014; Pfefferbaum, Adalsteinsson, & Sullivan, 2006; Sullivan et al., 2000a; Sullivan et al., 2000b), a recent meta-analysis suggested persistent dysfunctions in multiple cognitive processes after months of alcohol abstinence (Stavro et al., 2013). Impairments and/or improvements in each cognitive ability may differ depending on the recovery rate of each brain system, which underlie to these cognitive processes (Kish, Hagen, Woody, & Harvey, 1980; Pelletier et al., 2016; Pfefferbaum, Sullivan, Mathalon, Shear, Rosenbloom, & Lim, 1995; Stavro et al., 2013; Yohman, Parsons, & Leber, 1985).

Alcohol-related cognitive deficits may explain why therapeutic programs are not adequately processed (e.g., low participation in therapeutic workshops, absence of recording of therapeutic advice…), which in turn affect the effectiveness of rehabilitation programs due to the complexity in therapy programs (Berking, Margraf, Ebert, Wupperman, Hofmann, y Junghanns, 2011). Hence, a wider knowledge of cognitive and affective deficits could be employed to guide the development of early coadjuvant treatments, which allows to improve the affected cognitive domains and in turn reduce the rate of alcohol recidivism.

The current study was designed to address this gap in our understanding by investigating differences between long-term abstinent alcoholics (LTAA) and non-alcoholic individuals (control group), to establish differential neuropsychological profiles. In the light of previous findings regarding persistent cognitive impairments in patients with alcohol use disorders (AUD) after long-term periods of abstinence (Alhassoon et al., 2012; Fein, Torres, Price, & Di Sclafani, 2006; Munro, Saxton, & Butters, 2000; Nowakowska-Domagała, Jabłkowska-Górecka, Mokros, Koprowicz, & Pietras, 2017; Pfefferbaum et al., 2006; Stavro et al., 2013; Yohman et al., 1985), we hypothesized that LTAA would manifest neuropsychological dysfunctions relative to controls. The analysis of these cognitive profiles in LTAA are crucial for the patient's participation in relapse prevention programs.

Method

Participants

The final sample was composed of 79 men who participated voluntarily in the study: 40 LTAA and 39 individuals with no history of alcohol or drug consumption, as the control group. LTAA participants were recruited from Asociación Valenciana de Ex-Alcohólicos (*AVEX*), which offer a psychoeducational treatment program conducted by two psychotherapists. Moreover, participants were also recruited from the community by postings at Alcoholics Anonymous (AA) meetings, mailings and subject referrals. Inclusion criteria in the current study were diagnosis of Alcohol Use Disorder (AUD) assessed by the DSM 5; participants who have been abstinent for a minimum of twelve months (Fein et al., 2006); age above 18 and less than 60 years old; and ability to understand and speak Spanish. Exclusion criteria were suffer from any neurologic or psychiatric disease such as Alzheimer's or any type of dementia, past history of stroke or brain injurys, encephalopathy, and refusal to participate. All the individuals who were candidate participants were interviewed by trained researchers (with extensive experience treating AUD) to assess their mental health. Cohen's kappa, used to assess inter-rater agreement between qualitative interviewers in the nine psychopathological dimensions evaluated (the same dimensions as the Symptom Checklist 90-R, SCL-90-R), ranged from .67 to .84. Regardless of the SCL-90-R scores, the interviewees were considered not to have any psychopathological signs and symptoms if they scored less than the mean for their age for each dimension. They were then considered eligible to participate if the qualitative interviews and SCL-90-R scores confirmed they were free of mental illness. Four LTAA participants and five controls were excluded because their results suggested psychological disorders and additional current drug abuse.

Controls were recruited via internet advertisements and posting flyers around our city from January, 2016 to August, 2016. They were matched on socio-demographic characteristics. Furthermore, it would be necessary that they present alcohol consumption lower than 30 g/day, and less than two DSM-5 symptoms of AUD. High alcohol consumption was operationally defined as alcohol intake higher than 30 g/day (Cao, Willett, Rimm, Stampfer, & Giovannucci, 2015; Cho, Lee, Rimm, Fuchs, & Giovannucci, 2012; Scoccianti et al., 2016).

All participants were right-handed and healthy, were properly informed about the research protocol and gave written informed consent. The research was conducted taking into account current ethical and legal guidelines on the protection of personal data and research with human beings in accordance with the Declaration of Helsinki and was approved by the University of Valencia Ethics Committee (H1348835571691).

Procedure

All participants attended three sessions at the Faculty of Psychology. In the first session, participants were interviewed to exclude those with organic diseases and socio-demographic data were collected through a semi-structured interview. Then, participants were asked about their consumption of alcohol and cigarettes, in terms of both the amount consumed and how long they had been abstinent. Moreover, it was employed a breathalyzer to assess whether participants present a 0,0% alcohol concentration. Subsequently, they completed an inventory based on DSM-5 to check for the presence of AUD, and the Fragerström test of nicotine dependence to assess addiction level. Lastly, they were asked if they had a history of traumatic brain injury, noting whether they had lost consciousness during the trauma; for example, had they been involved in fights, and if so, how often had this resulted in head injuries and had they had blackouts after these injuries. In fact, there were excluded those participants who suffered a severe TBI. Finally, other psychological tests were studied in order to complete participant's profile.

The second and third sessions spread over two consecutive days, a range of neuropsychological variables were assessed using traditional tests and also the computer-based Cambridge Neuropsychological Test Automated Battery (CANTAB) ordered as presented in table 2. This neuropsychological testing was build based on Ruiz-Sánchez de León, Pedrero-Pérez, Rojo-Mota, Llanero-Luque, & Puerta-García (2011) recommendations. If any of participants was a smoker, he was asked to smoke previously to the neuropsychological assessment to avoid any bias related to the abstinence of nicotine

The end of the assessment was marked by displaying a sign saying "Thank you very much", participants were paid €20 for their participation and told that they could leave.

Frontal Behaviour

Spanish version of *Frontal Systems Behaviour Scale (FrSBe)* is composed of 46 items that measure frontally-based behavioural syndromes such as disinhibition (15 items), apathy (14 items) and executive dysfunction (17 items) (Pedrero-Pérez, Ruiz-Sánchez de León, Llanero-Luque, Rojo-Mota, Olivar-Arroyo, & Puerta-García, 2009), all being rated on a 5-point Likert-type scale (1 = 'not at all' to 5 = 'very much so').

We used the translated into Spanish version of the Montreal cognitive assessment (MoCA) (http://www.MoCA-test.org/). The MoCA measures eight cognitive domains such as naming, attention, language, abstraction, delayed memory, orientation, visuospatial and executive abilities. The initially proposed normal MoCA score is ≥ 26, but a point must be added to the total score in participants with low educational level (less than 12 years of education).

IQ (abstract reasoning and processing speed) (table 1)

Abstract reasoning and processing speed were measured by the subtests matrix reasoning, digit symbol-coding, symbol search and similarities of the WAIS-III (Wechler, 1999).

Attention (table 1)

We employed the translated version into Spanish of the d2 test, which measures the ability to focus on relevant stimulus while ignoring irrelevant (Seisdedos, 2004). It consists in 14 lines with 47 characters each one, which contains letters such as «d» and «p». Participants should check during 20 seconds for each line from left to right, the contents of each line marking only «d» showing two little dashes (both above, below or one above and one below). Dependent scores for this study were: TR, overall answer; TA, number of correct guesses; O, omitted elements; C, commissions; TOT, total test effectiveness; and CON concentration index.

Attention Switching Task (ATS) measures the ability to switch attention between the direction of an arrow and its location on the screen and avoiding distracting events. It is a highly cognitive demanding test as participants should switch their attention between congruent (e.g., arrow on the right side of the screen pointing to the right) and incongruent stimuli (e.g., arrow on the right side of the screen pointing to the left) presentation. Dependent variables for this study were switch cost, percentage of correct responses and congruency cost (Cambridge Cognition Ltd, 2012).

Rapid Visual Information Processing (RVP) measures sustained attention. This test consists in a white box appears in the centre of the computer screen, inside which digits, from 2 to 9 are presented randomized. Subjects should detect specific target sequences of three consecutive digits (e.g., 2,4,6; 3,5,7 and 4,6,8). Dependent variable for this study was target sensitivity.

Choice Reaction Time (CRT) is a 2-choice reaction time test that assesses attentional ability and reaction times, which includes a practice stage of 24 trials and two assessment stages of 50 trials each. Dependent variables for this study were percentage of correct answers and mean correct latency (ms) (Cambridge Cognition Ltd, 2012).

Table 1. *Neuropsychological test battery.*

Neuropsychological test	
IQ	
Matrix reasoning WAIS-III	Abstract reasoning
Digit symbol-coding and symbol search	Processing speed
Similarities of the WAIS-III	Verbal reasoning
Attention	
d2 test	Sustained attention
Rapid Visual Information Processing (RVP)	Sustained attention
Attention Switching Task (AST)	Switch-attention
Choice Reaction Time (CRT)	Reaction times
Memory	
Word List WAIS-III	Immediate recall, delayed recall and recognition.
Rey–Osterrieth Complex Figure Test	Visuospatial constructional ability and visual memory
Logical Memory WMS-III	Short and long-term memory and recognition
Digit Span WAIS-III	Short-term memory, attention, and concentration
Letter-Number Sequencing WAIS-III	Simultaneously recall and organize stimuli (working memory)
Spatial Span WMS-III	Working memory capacity (visuospatial)
Spatial Span Test (CANTAB)	Working memory capacity (visuospatial)
Executive functions	
Semantic categorial evocation of animals and FAS verbal phonemic fluency	Verbal fluency
Stroop	Divided attention and resistance to interference
Hayling test	Verbal inhibition
Five-Point test	Design fluency
Wisconsin Card Sorting Test (WCST)	Abstract reasoning and the ability to change cognitive strategies in response to environmental changes (cognitive flexibility)
Zoo test and Key test	Ability to plan a strategy to solve a problema (planning)
One Touch Stockings of Cambridge (OTS)	Spatial planning and working memory
Cambridge Gambling Task (CGT)	Decision-making and risk-taking behaviour
Empathy	
Reading the mind in the eyes	Emotion decoding abilities

Memory (table 1)

Word List is a subscale of the WMS-III (Wechler, 1997). Participants must recall a list of words presented five times, and each time, the participant has to repeat the maximum number of words that he/she can recall. Moreover, there is an interference list. This test consists of three test conditions: immediate recall, delayed recall and recognition.

Rey–Osterrieth Complex Figure Test assessed visuospatial constructional ability and visual memory. This test consists of three test conditions: copy, immediate recall and delayed recall. Initially, participants must copy a stimulus card. Afterwards, the card is taken away and they are instructed to draw what they remember of the figure. Finally, participants must draw the same figure once again after 30 minutes.

WMS-III *Logical Memory* evaluates short and long-term memory and recognition of two stories. Participants should remember as many ideas as possible from two stories (Wechler, 1997).

Digit Span is a subscale of the WAIS-III, which measures short-term memory, attention, and concentration. Participants are asked to repeat digits in direct and inverse order (Wechsler, 1999).

Letter-Number Sequencing is a subscale of the WAIS-III, which measures the ability to simultaneously recall and organize stimuli (working memory). Subject should repeat several series by repeating the numbers in ascending order, and then the letters in alphabetical order (e.g., 9-L-2-A; correct response is 2-9-A-L) (Wechsler, 1999).

Spatial Span is a subscale of the WMS-III, in which participants must copy a series of moves made by the evaluator with increasing difficulty. There are also two parts (direct and inverse order).

Spatial Span Test from the CANTAB measures working memory capacity. It has been presented white squares, some of which briefly change colour in a variable sequence. This test is stopped when the subject fails three consecutive trials at any specific level. The maximum number of boxes correctly defines the final score obtained (Cambridge Cognition Ltd, 2012).

Executive function tests (table 1)

Verbal fluency

Semantic categorial evocation of animals consists of asking the patient to say as many animal names as he can in about 60 seconds. It has been assigned 1 point for each correct animal name evoked in that time interval, without a maximum score (Del Ser Quijano, Sanchez Sánchez, Garcia de Yebenes, Otero Puime, Zunzunegui, & Muñoz, 2004). Moreover, in the F-A-S verbal phonemic fluency participants must produce as many words as possible with each of the three test letters previously presented during 60 seconds each one.

Inhibition

The Stroop color and word test measures the ability of divided attention and resistance to interference (Spreen & Strauss, 1991).

For the assessment of verbal inhibition we employed the Hayling test (Burgess & Shallice, 1997).

Cognitive flexibility

For *Design fluency* was employed the Five-Point test, which involves the uses of a structured background that consists of a sheet of paper with 40- dot matrices (five columns x eight rows). Participants should draw as many different figures as possible by connecting any numbers of dots from the 5 dots within each cell to create novel designs within 60 seconds (Lezak, 2004).

Wisconsin Card Sorting Test (WCST) measures abstract reasoning and the ability to change cognitive strategies in response to environmental changes. It consists of 4 stimulus cards and 128 response cards containing various colours (red, blue, yellow or green), shapes (circle, cross, star or triangle) and numbers (one, two, three or four) of figures (Heaton, Chelune, Talley, Kay, & Curtiss, 1993).

Planning

Zoo test and *Key test* are part of the Behavioural Assessment of Dysexecutive Syndrome (Wilson, Alderman, Burgess, Emslie, & Evans, 1996).

One Touch Stockings of Cambridge assesses spatial planning and working memory based upon the Tower of Hanoi test. The participant is shown two displays containing three coloured balls. Dependent variables are problems solved on first choice, mean choices to correct, mean latency to first choice and mean latency to correct (Cambridge Cognition Ltd, 2012).

Decision making

Cambridge Gambling Task measures decision-making and risk-taking behaviour. It has been presented a row of ten boxes across the top of the screen, some red and some blue. Rectangles containing the words 'red' and 'blue' can be seen at the bottom of the screen. Participants then have to decide whether the yellow taken is hidden in a red box or in a blue box. A set of points to gamble with is shown on the screen, which are displayed in rising or falling order. Participants are allow to place whatever bet they want with the number of points provided in order to gamble on their confidence in this judgement. The participants are aske to earns as many points as possible (Cambridge Cognition Ltd, 2012).

Empathy (table 1)

Eyes Test measures emotion decoding abilities by identifying the emotion that best represents the expression of the eyes in 36 photographs that show the eye region of the face of different men and women. In fact, subjects must choose one of a set of four adjectives. Total score, which ranged from 0 to 36 points, is obtained by summing the number of correct answers (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001), being interpreted a higher score as indicative stronger emotional decoding abilities.

The Spanish version *Interpersonal Reactivity Index* measures empathic response (Mestre, Frías, & Samper, 2004), which includes four subscales such as perspective taking and fantasy (cognitive empathy) and emotional empathic concern and personal distress (emotional empathy). Responses are given on a 5-point Likert scale. The total score ranged from 7 to 35 points in each subscale, and a higher score indicate higher empathic skills.

Alexithymia was assessed using the Spanish version of the Toronto Scale of 20 Elements (TAS-20) by Bagby, Parker & Taylor (1994). It is a scale of 20 Likert type reagents with 6 variation points per element (from 0 to 5).

Data analysis

The Shapiro-Wilk test was used for exploring whether the data were normally distributed. Due to the fact that the majority of variables did not meet the assumption of normality ($p < .05$), therefore, it was decided to carry out nonparametric tests for statistical analysis of the results. U Mann–Whitney test was used to check for significant differences between the groups in socio-demographic, questionnaire scores and neuropsychological test. In addition, chi square analyses were performed for categorical variables such as socio-demographic characteristics (nationality, marital status, level of education, employment status, etc.).

Data analyses were carried out using IBM SPSS Statistics for Windows, Version 22.0 (Armonk, NY, USA). P values < 0.05 were considered statistically significant. Average values are reported in tables as mean±SD.

Results

Sample characteristics

Descriptive characteristics for LTAA and controls are presented in Table 2. Regarding AVEX (85% sample) and AA patients (15% sample) there were not differences between clinical and socio-demographic characteristics. Groups did not differ in anthropometric or socio-demographic variables, personal history of traumatic brain injury, or temporary loss of consciousness. Nevertheless, they differed in self-reported executive dysfunction, (Mann–Whitney $U = -2.64$, $p = 0.008$), and apathy, (Mann–Whitney $U = -2.80$, $p = 0.005$), with LTAA obtaining higher scores than controls. Moreover, a significant effect for group was found in IQ matrix Reasoning, (Mann–Whitney $U = -3.42$, $p = 0.001$), IQ similarities, (Mann–Whitney $U = -3.42$, $p = 0.001$), and IQ copy (Mann–Whitney $U = -3.03$, $p = 0.002$), having LTAA higher scores in all these scales than controls.

Table 2. *Mean ± SD of descriptive characteristics for all groups (*p < .05).*

	Alcohol group (n = 40)	Controls (n = 39)
Age (years)	45.55 ±8.99	42.05 ±11.33
BMI (Kg/m²)	27.74 ±3.42	26.90 ±4.96
Nationality		
Spanish	34 (85%)	32 (82%)
Latin Americans	6 (15%)	7 (18%)
Marital status		
Single	15 (38%)	17 (44%)
Married	9 (23%)	9 (23%)
Separate/Divorced/Widowed	16 (40%)	10 (26%)
Number of children	.94 ±1.03	1.20 ±0.95
Level of education		
Primary/lower secondary	18 (45%)	18 (46%)
Upper secondary/vocational training	17 (43%)	17 (44%)
University	5 (12%)	4 (10%)
Employment status		
Employed	18 (45%)	18 (46%)
Unemployed	22 (55%)	21 (54%)
Income level		
1800€ – 12000€	25 (63%)	25 (64%)
12000€ – 30000€	12 (30%)	12 (31%)
> 30000€ – 90000€	3 (7%)	2 (5%)
Personal history of traumatic brain injury	13 (48.14%)	14 (40%)
Yes	14 (51.85%)	21 (60%)
No		
Temporary loss of consciousness		
Yes	8 (29.36%)	14 (40%)
No	19 (70.37%)	21 (60%)
Alcohol Use Variables		
Age started drinking	17.74 ±8.82	-
Age at first heavy use	22.75 ±7.92	-
Average lifetime drinking dose (gr/day)	202.84 ±148.69	
Duration of active drinking (years)	22.80 ±8.82	-
Time of alcohol abstinence (months)	40.72 ±77.40	-
Family members with AUD		
Yes	37%	-
No	63%	-
Cigarettes/day*	16.61 ±10.13	9.75 ±7.21
Fagerstrom test	4.84 ±3.91	3.17 ±1.11
Frontal Behavior test		
Executive dysfunction**	19.77 ±9.54	13.14 ±7.14
Apathy**	10.33 ±5.77	6.25 ±4.94
Desinhibition	9.33 ±4.47	7.05 ±3.51

Neuropsychological assessment
Attention and memory (table 3)

Attention

We checked group differences and observed a number of differences that approached significance in the D2 Test, especially the total number of characters processed (Mann–Whitney U = -3.42, p = 0.001), total correctly processed (Mann–Whitney U = -2.97, p = 0.003), total number of errors (Mann–Whitney U = -2.83, p = 0.005), total performance (Mann–Whitney U = -3.42, p = 0.001) and concentration performance (Mann–Whitney U = -3.37, p = 0.001), while LTAA had a lower number total number of characters processed and total correctly processed, worse D2 and concentration performance and made more errors than controls. Regarding RVP, a significant group effect was found (Mann–Whitney U = -2.32, p = 0.021), LTAA performing less well in detecting the target sequences than controls.

Memory

Regarding the Wechsler Memory Scale-III Word List subscale, the difference between groups for the total number of words remembered (Mann–Whitney U = -4.19, p > 0.001), the number of words remembered in the first trial (Mann–Whitney U = –3.19, p = 0.001), short-term memory (Mann–Whitney U = -2.32, p = 0.020), the interference list (Mann–Whitney U = -4.19, p > 0.001) and recognition (Mann–Whitney U = -2.74, p = 0.006) were significant. LTAA remembered and recognized fewer words than controls.

For the ROCF test, “group” proved to be significant for copy time (Mann–Whitney U = -3.12, p = 0.002), short-term memory score (Mann–Whitney U = -3.17, p = 0.001), and long-term memory score (Mann–Whitney U = -3.48, p = 0.001), with LTAA needing more time to copy the figure and remembering the figure less well (both short-term and long-term) than controls.

Regarding the Logical Memory subscale, a significant effect of group was found in the first time that text A was read (Mann–Whitney U = -2.85, p = 0.004), text A units (Mann–Whitney U = -2.93, p = 0.003), and text B units 1, (Mann–Whitney U = -2.57, p = 0.010), and topics 1 (Mann–Whitney U = -2.12, p = 0.034) and text B units 2, (Mann–Whitney U = -2.05, p = 0.040), and topics 2 (Mann–Whitney U = -2.07, p = 0.039), LTAA remembered fewer units and topics than controls. Therefore, there were also group effects for delayed recalled of text A units (Mann–Whitney U = -2.06, p = 0.039) and topics, (Mann–Whitney U = -2.87, p = 0.004) and text B units (Mann–Whitney U = -1.97, p = 0.004), LTAA obtaining worse scores, meaning that they remembered both texts less well, than controls. There were also group effects for the recognition task (Mann–Whitney U = -3.72, p < 0.001), the LTAA group having lower scores than controls.

In the Digits Span subscale, though no significant differences were found between groups in direct scores, “group” was found to be significant in inverse order (Mann–Whitney U = -3.83, p < 0.001),, LTAA remembering fewer digits, especially in inverse order, than controls. Similarly, regarding the Letter-Number Sequencing subscale, there was a “group” effect (Mann–Whitney U = -3.83, p < 0.001), with LTAA remembering fewer letters and numbers than controls.

Tabla 3. *Mean ±SD of Memory tests of all grups (*p < .05)*

	Alcohol group (n = 40)	Controls (N = 39)
IQ		
Speed processing		
Symbol search	30.05 ±8.89	33.98 ±9.35
Abstract reasoning		
Digit Symbol - Coding		
Coding**	60.72 ±14.31	70.58 ±14.08
Incidental Learning Pairing*	10.21 ±5.39	12.50 ±4.96
Incidental Learning Free Recall	6.41 ±2.55	7.40 ±1.46
Copy**	103.51 ±23.16	117.40 ±18.76
Matrix Reasoning***	11.74 ±4.51	16.55 ±6.49
Similarities*	16.33 ±4.52	18.73 ±4.33
Attention		
D2		
TR***	387.18 ±95.94	485.70 ±79.37
O	23.92 ±22.64	30.55 ±31.00
C**	17.87 ±31.53	8.93 ±18.80
TA**	136.97 ±39.72	165.78 ±41.07
TOT= TR - (0 ± C)***	345.38 ±88.85	419.23 ±88.37
CON= TA –C***	119.10 ±42.93	156.85 ±51.49
E%= (100(O ±C))/TR	10.78 ±7.68	8.80 ±9.99
AST		
Switch cost	-146.33 ±136.41	-142.44 ±116.85
Percentage of correct responses (%)	89.31 ±11.24	93.03 ±6.73
Congruency cost	115.25 ±119.01	92.17 ±81.56
RVP Sensitivity (from .0 to 1.00)*	0.89 ±0.05	0.91 ±0.08
CRT		
Percentage of correct answers (%)	99.15 ±1.05	99.32 ±0.91
Mean correct latency (ms)	424.15 ±81.47	411.20 ±93.76
Memory		
Word Lists test		
Total words recalled***	28.91 ±5.38	34.64 ±4.99
Short-term memory*	7.51 ±2.00	8.36 ±1.94
Long-term memory*	6.76 ±2.14	7.72 ±2.16
First trial***	4.92 ±1.49	6.00 ±1.37
Learning curve	3.75 ±1.92	4.54 ±1.57
Interference list***	3.73 ±1.61	5.28 ±1.67
Omission	1.78 ±1.64	2.31 ±1.49
Recognition**	22.43 ±1.21	22.97 ±1.55
Rey Figure		
Copy score	34.86 ±1.39	35.31 ±1.23
Copy time**	152.24 ±59.70	118.93 ±44.86
Short-term memory score***	19.92 ±7.25	25.10 ±6.01
Short-term memory time	119.54 ±43.19	110.08 ±45.23
Long-term memory score***	19.19 ±6.21	24.46 ±6.38
Long-term memory time	95.77 ±33.82	93.46 ±32.57
Logical Memory test		
Delayed recall:		
Total score on the first try**	22.65 ±7.85	27.23 ±6.85
Text A		
Units**	11.93 ±3.45	14.15 ±3.84
Topics	4.60 ±1.99	5.41 ±1.27
Text B		
Units 1*	10.45 ±4.53	13.08 ±3.72
Topics 1*	4.45 ±2.36	5.72 ±1.10
Units 2*	10.45 ±4.53	10.45 ±4.53
Topics 2*	4.45 ±2.36	4.45 ±2.36
Delayed recall:		
Text A		
Units*	9.00 ±4.37	10.87 ±3.85
Topics**	4.10 ±2.01	5.38 ±1.37
Text B		
Units*	14.45 ±4.85	16.41 ±4.93
Topics	5.13 ±1.91	5.92 ±1.27
Recognition***	23.70 ±3.24	25.82 ±4.93
Digits		
Direct order	8.47 ±1.61	9.00 ±2.71
Inverse order***	5.06 ±1.53	6.90 ±2.19
Total score**	13.55 ±2.56	15.90 ±4.47
Letters and numbers		
Total score***	8.44 ±2.10	10.85 ±2.77
Spatial location		
Direct order	8.64 ±1.76	9.23 ±1.77
Inverse order**	7.14 ±1.59	8.38 ±2.18
Total score*	15.79 ±2.80	17.62 ±3.38

Table 4. *Mean ±SD of executive functions and empathy tests scores for all groups (*p < .05).*

	HA (n = 40)	LA (n = 39)
Verbal fluency		
Semantic (animals)	21.64 ±5.62	23.85 ±4.68
Phonemic (F, A and S)	37.33 ±12.11	40.38 ±13.82
Design fluency		
Part A***	15.26 ±5.15	19.38 ±5.53
Part B*	16.97 ±5.10	10.30 ±5.16
Inhibition		
Stroop 1*	100.23 ±14.34	108.38 ±14.52
Stroop 2	70.23 ±11.07	72.00 ±11.95
Stroop interference*	39.33 ±8.47	44.03 ±11.24
Hayling part A		
Time (sec)*	1.87 ±1.06	1.43 ±0.84
Score**	14.00 ±0.93	14.37 ±0.95
Hayling part B		
Time (sec)	4.65 ±3.82	3.83 ±3.09
Score	13.97 ±8.05	11.90 ±8.15
Cognitive flexibility		
Total trials***	113.32 ±19.41	93.40 ±21.17
Correct trials*	74.11 ±12.61	67.45 ±9.68
Total errors*	39.21 ±22.14	26.35 ±21.64
Perseverative mistakes*	21.71 ±13.07	13.90 ±13.57
Non perseverative mistakes*	17.39 ±11.79	11.87 ±10.22
Random not perseverative errors*	24.18 ±19.46	15.97 ±16.58
Completed categories*	4.34 ±1.79	5.33 ±1.56
Attempts to complete the first category	21.32 ±22.70	16.02 ±19.02
Failure to maintain the set**	1.37 ±1.65	0.40 ±0.95
Planning		
Zoo version 1		
Planning time (sec)	72.32 ±45.88	61.27 ±26.50
Execution time (sec)*	71.56 ±33.59	56.40 ±33.84
Errors	1.41 ±1.74	1.13 ±1.20
Total score version 1	3.15 ±3.45	3.97 ±2.81
Zoo version 2		
Planning time (sec)	32.51 ±19.03	23.19 ±12.72
Execution time (sec)*	45.23 ±20.14	35.37 ±18.66
Errors	0.59 ±0.97	0.36 ±0.67
Total score version 2	6.26 ±2.11	7.03 ±1.97
TOTAL SCORE	9.49 ±4.80	11.00 ±3.80
Key Test		
Planning time (sec)	20.76 ±29.39	14.94 ±14.53
Execution time (sec)*	36.51 ±36.23	32.64 ±26.18
Total score***	6.79 ±3.51	11.21 ±3.58
OTS problems solved on first choice* **	15.03 ±3.02	16.00 ±4.45
OTS mean choices to correct* **	1.71 ±0.53	1.63 ±0.46
Problems with:		
1 moves	1.17 ±0.53	1.12 ±0.22
2 moves	1.25 ±0.39	1.17 ±0.42
3 moves**	1.42 ±0.49	1.37 ±0.46
4 moves***	1.67 ±0.58	1.60 ±0.59
5 moves*	1.97 ±0.84	1.79 ±0.73
6 move***	2.79 ±1.15	2.72 ±1.08
OTS mean latency to first choice	14673.62 ±7265.36	18906.10 ±11429.33
Problems with:		
1 moves***	8747.65 ±3302.95	12087.74 ±9363.30
2 moves*	7082.91 ±22705.63	7825.22 ±23041.18
3 moves	8965.16 ±4337.98	10427.44 ±4870.10
4 moves	14439.84 ±11311.03	16357.72 ±9071.56
5 moves	24721.74 ±16877.17	26256.96 ±18742.32
6 move	24084.41 ±17827.82	40481.52 ±48533.45
OTS mean latency to correct		
Problems with:		
1 moves***	9313.49 ±3694.57	14111.03 ±11395.22
2 moves*	8902.96 ±3818.69	10136.43 ±7401.45
3 moves*	11758.40 ±8527.88	13884.02 ±8386.89
4 moves*	22097.44 ±24259.04	22477.01 ±13627.41
5 moves	35255.63 ±25785.04	35885.43 ±23406.45
6 moves	39906.75 ±28624.96	57317.70 ±51771.00
CGT		
Delay aversion	.19 ±.28	.13 ±.19
Deliberation time	2722.61 ±893.26	2587.29 ±801.52
Proportion bet	.50 ±.13	.51 ±.18
Quality of decision making	.88 ±.11	.85 ±.16
Risk adjustment	.95 ±.88	.78 ±.90
Risk taking	.54 ±.13	.55 ±.17
Empathy		
IRI		
Perspective taking	22.86 ±5.87	22.79 ±4.81
Fantasy	18.59 ±5.05	19.21 ±6.67
Empathic concern	25.47 ±4.17	25.95 ±3.54
Personal distress***	16.21 ±4.26	12.00 ±3.00
Eyes Test		
Total score	23.03 ±4.50	22.43 ±4.261
TAS **	63.92 ±12.93	54.89 ±11.60

With regards to the Spatial Span subscale, “group” proved to be significant in inverse order (Mann–Whitney U = -2.65, p = 0.008), and total score (Mann–Whitney U = -2.13, p = 0.033), with LTAA being less able to repeat the series of movements made by the evaluator than controls. However, there were no significant differences between groups in direct order Spatial Span score.

Executive functions and empathic skills (table 4)

Cognitive flexibility

A significant “group” effect was found for the following WCST scales: total trials, (Mann–Whitney U = -3.83, p < 0.001); correct trials, (Mann–Whitney U = -2.89, p = 0.004); total errors, (Mann–Whitney U = -2.82, p = 0.005); perseverative errors, (Mann–Whitney U = -3.29, p = 0.001); rate of perseverative errors, (Mann–Whitney U = -2.61, p = 0.009); non-perseverative errors, (Mann–Whitney U = -2.34, p = 0.019); completed categories, (Mann–Whitney U = -3.02, p = 0.003), and failures to maintain the set, (Mann–Whitney U = -3.54, p < 0.001). LTAA needed more trials, made more errors, completed fewer categories, and more often failed to maintain the set than controls (Table 4).

Planning

Regarding the Zoo test, group proved to be significant in execution time (Mann–Whitney U = -2.27, p = 0.023), and execution time of version 2 (Mann–Whitney U = –2.92, p = 0.008), with LTAA spending more time planning than controls, which means that they had more problems developing logical strategies than controls.

There was a significant group effect for the total score on the Key test (Mann–Whitney U = -4.65, p < 0.001), LTAA being less able to plan a strategy to solve a problem than controls. Nevertheless, no significant differences were found between groups in planning and execution time.

A significant “group” effect was found in the OTS problems solved on the first choice (Mann–Whitney U = -3.84, p < 0.001), and in mean choices to correct total (Mann–Whitney U = -3.70, p < 0.001), third (Mann–Whitney U = -3.11, p = 0.002), fourth (Mann–Whitney U = -3.44, p = 0.001), fifth (Mann–Whitney U = -2.30, p = 0.022) and sixth (Mann–Whitney U = -3.77, p < 0.001) movements to correct, LTAA requiring more movements to finish the exercises and achieving less good performance than controls. Nonetheless, there were no significant differences in trials which only required one or two movements. Finally, a group effect was also found for latency to first choice (1 move) (Mann–Whitney U = -3.61, p < 0.001), (2 moves) (Mann–Whitney U = -2.52, p = 0.012) and latency to finish exercises correctly in exercises that need one movement (Mann–Whitney U = -3.84, p < 0.001), 2 moves (Mann–Whitney U = -2.35, p = 0.019), and 4 moves (Mann–Whitney U = -2.08, p = 0.038). Specifically, LTAA took more time to do the movements than controls.

Decision making

Regarding the CGT, no significant differences were found between groups in the proportion bets (Mann–Whitney U = -.13, p = 0.895), delay aversion (Mann–Whitney U = -1.26, p = 0.208), deliberation time (Mann–Whitney U = -.71, p = 0.474), quality of decision making (Mann–Whitney U = -.11, p = 0.914), risk adjustment (Mann–Whitney U = -.95, p = 0. 344) and risk taking (Mann–Whitney U = -.05, p = 0.953).

Empathy

A significant group effect was found in the IRI Personal distress (Mann–Whitney U = -4.29, p < 0.001), with LTAA presenting higher scores than controls. Nonetheless, groups did not differ in fantasy, empathic concern or perspective taking. With regards to the TAS, group proved to be significant (Mann–Whitney U = -2.94, p = 0.003), LTAA obtaining higher scores than controls. Finally, there were not found differences between groups in eye test.

The calculated type II error ranged from 1% to 12% in all the analysis.

Discussion

In the present study, we compared the neuropsychological performance on a computerized battery with pencil-and-paper tests of LTAA with non-alcoholic matched for demographic variables controls. We initially hypothesized that LTAA would manifest more neuropsychological dysfunctions, particularly memory and executive dysfunction, than controls. As expected, the LTAA group presented deficits in the abstract reasoning, speed processing, sustained attention, working and long-term memory (verbal, logical and visuospatial), cognitive flexibility, inhibition and time of planning. In addition, the LTAA had significantly more personal distress and alexithymic symptoms than the controls, though they did not differ from the controls in perspective taking, fantasy, empathic concern and emotional decoding skills.

Our study reinforces that certain cognitive skills such as abstract reasoning, speed processing, sustained attention, working and long-term memory (verbal, logical and visuospatial), cognitive flexibility, inhibition and time of planning might be persistently impaired after long term abstinence (Fein et al., 2006; Stavro et al., 2013). Additionally, LTAA also showed higher self-reported executive dysfunction, apathy, disinhibition and impulsivity in comparison with controls. In fact, it has been suggested that a result of chronic hazardous alcohol use could increase the risk of disinhibition and impulsivity, which entails a lack of concern for the consequences of inappropriate behaviours (Kravitz et al., 2015; Staples & Mandyam, 2016). These alcohol-related disinhibitory behaviors can be traced by neurobiological abnormalities such as prefrontal cortex, which is part of the substrate for executive control (Abernathy, Chandler, & Woodward, 2010).

Based on WCST and OTS performance, LTAA presented less cognitive flexibility and weaker planning skills than controls. This means that they have problems to use negative feedback, suggesting they are less able to learn from aversive experience and modify behaviours in light of this learning. They also had problems developing logical strategies, with their abstract reasoning and they also need more time to planning their decisions and inhibit inappropriate responses than controls. It seems logical to conclude that these deficits could be explained by LTAA sustained attention and working memory impairments', which constrain the ability to learn, remember and adaptively utilize associations, reasoning, and problem solving.

Whether good decision making is a result of an accurate judgment of anticipated outcomes (Clark, et al., 2011), attention and memory complaints may lead to ignorance of possibly advantageous choice alternatives or avoid unnecesary risks in decision-making situations. In fact, speed processing, attention and memory are important for these abilities, allowing focus on relevant stimuli and in inhibiting automatic thinking. Nonetheless, as LTAA did not differ from controls in CGT decision-making, we can't assume that LTAA make risky and/or impulsive decisions. Conversely, a previos research concluded that LTAA exhibited poor decision-making on the Iowa Gambling Task, which was attributed to their tendency to immediate reward than by delayed punishment (Fein et al., 2006). These differences between studies could be attributed to methodological reasons such as the neuropsychological tests employed in each study and/or by heterogeneity of AUD samples (time of abstinence, number of years of alcohol consumption, *polydrug* abuse, etc). However, it is important to note that in our study other cognitive processes requiring switch-attention, reaction times, verbal fluency, verbal inhibition, cognitive empathy and emotional decoding abilities seem well preserved. As the somatic marker model proposes that decision-making depends on cognitive and emotional processes (Gutnik, Hakimzada, Yoskowitz, & Patel, 2006), the relatively well preserved cognitive and emotional abilities may help LTAA avoid unnecessary risks, but our data demonstrated that LTAA need more time to plan o make a choice than non-alcoholic controls. Therefore, our results underscoring the view that cognitive flexibility, inhibition or planning impairments are the main and determinant cause of decision-making deficits.

Several studies have been reported persistent deficits for processes related to social cognitive information, decoding of affective states, empathic ability, and in theory-of-mind in individuals with prolonged alcohol abstinence (Grynberg, Maurage, & Nandrino, 2017; Maurage, Pesenti, Philippot, Joassin, & Campanella, 2009; Stasiewicz et al., 2012). Additionally, sober alcohol patients tend to present difficulties to identify, differentiate, and express feelings (alexithymic symptoms) (Stasiewicz et al., 2012). Our results partially reinforced previous research in this field. Indeed, LTAA exhibited higher self-reported personal distress and alexithymic symptoms in comparison with controls. Conversely, they did not showed differences in cognitive empathy and emotional decoding abilities in comparison with controls. Based on or data, we could conclude that specific empathic measures did not present deficits after long-term abstinence, with the notable exception of personal distress and alexhitimia, on which alcoholism-related deficits remained. As regulate distressing emotional experiences and interpersonal difficulties to identify, differentiate, and express feelings has been associated with relapse after detoxification (Zywiak, Westerberg Connors, & Maisto 2003), this suggest the importance to consider emotional and interpersonal difficulties in clinical treatment for alcoholics.

The main limitation of the study is that the sample sizes were modest. For this reason, the findings should be considered preliminary, and further research is needed to explore these patterns in larger samples. Another limitation of the current study is the use of cross-sectional data rather than longitudinal data, and hence definitive conclusions cannot be drawn regarding the long-term effects of alcohol in these cognitive skills. Moreover, it would be possible that alcoholics present pre-existent cognitive deficits to alcohol consumption, which increase their proneness to alcohol abuse. Hence, we can not demonstrate cognitive recovery or impairments over time. Longitudinal studies are necessary to understand how duration of alcohol abstinence could contribute to scope and limitations of recovery of emotional and social abilities. Additionally, it would be necessary to specify the role of these cognitive deficits in alcohol-relapse. Another limitation, the neuropsychological tests employed to assess these deficits tend to measure broad categories of abilities without a homogeneous consensus on which specific attributes define these functions.

Finally, it seems logical that these deficits may interfere in workshops, and psychotherapy in alcoholic patients during the detoxification period. Indeed, the large amounts of verbal and complex material presented in therapy programs is not being adequately processed due to conceptual thinking and abstract reasoning impairments in alcoholics. Nevertheless, it should be mentioned that the absence of recording therapeutic advice or low participation in workshops might also reflects participants' non-engagement with the program and not necessarily cognitive deficits. It may be necessary to develop early coadjuvant neuropsychological rehabilitation program to existent psychotherapy programs after detoxification (Teixidor López, Frías-Torres, Moreno-España, Ortega, Barrio, & Gual, 2017). Hence, this knowledge could be employed to guide the development of early coadjuvant treatments, which allows to improve the affected cognitive domains and in turn reduce the rate of alcohol recidivism.

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Could Alcohol Abuse Drive Intimate Partner Violence Perpetrators' Psychophysiological Response to Acute Stress?

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Abstract: Proactively aggressive individuals have been shown to present a different pattern of autonomic nervous system (ANS) dysregulation from that of individuals characterized by reactive violence. Although attempts have been made to classify intimate partner violence (IPV) perpetrators based on ANS reactivity to acute stress, subsequent studies have failed to replicate this classification. Notably, the proposed classification neglected the role of chronic alcohol abuse in ANS dysregulation and the fact that this dysregulation entails an abnormal stress response. The aim of the present study was to analyze the response profile (psychological state and ANS response) of groups of IPV perpetrators with high (n = 27) and low (n = 33)-risk alcohol use to an acute stressor, compared to controls (n = 35). All IPV perpetrators scored higher on executive dysfunctions and impulsivity and showed larger decreases in positive affect, less satisfaction, and a higher external locus of control after the stressor than controls. IPV perpetrators with low-risk alcohol use had higher skin conductance levels and breathing reactivity than controls, especially during preparatory, task, and recovery periods. This information could help to develop methods for increasing batterers' behavioral self-regulation, thus decreasing IPV recidivism risk.

Keywords: acute stress; cardiorespiratory variables; impulsivity; intimate partner violence; skin conductance; autonomic nervous system

1. Introduction

Scientifically strong evidence has shown that autonomic nervous system (ANS) functioning can be employed as a classification criterion in violent men because perpetrators of proactive and reactive violence present a different pattern of autonomic dysregulation [1–9]. Nevertheless, it is not clear whether resting values of ANS measures accurately reflect proneness to violence. Therefore, it would be advisable to consider resting values as well as ANS reactivity to stress and/or specific stimuli in order to characterize the profile of generally violent individuals.

Regarding intimate partner violence (IPV), Gottman, Jacobson, Rushe, and Shortt [10] found evidence supporting two different IPV perpetrator categories, based on batterers' psychophysiological reactivity to an acute laboratory stressor (marital conflict). On the one hand, these batterers were classified as Type I if they showed heart rate (HR) hypoactivity in confronting this type of stressor. In fact, Gottman et al. [10] interpreted batterers with this profile as psychopathic because they presented proactive violence and were more violent than the other batterers. Furthermore, IPV perpetrators of this type tend to employ manipulative strategies to control their wives. On the other hand, IPV perpetrators were classified as Type II if they presented HR hyperreactivity to stress. Additionally, they scored higher on dependent personality traits, and they usually employed impulsive/reactive violence. Nevertheless, two later studies by Babcock, Green, Webb, and Graham [11] and Meehan, Holtzworth-Munroe, and Herron [12] failed to replicate this classification. Although both studies employed similar methodologies (HR and psychological measurements and a laboratory stressor) as in Gottman et al. [10], the authors attributed their failure to replicate earlier findings to a methodological weakness in the initial study that interfered with the HR reactivity calculation. Specifically, Gottman et al. [10] measured HR resting values over a very short period of time, whereas the later studies used longer resting times in order to increase the reliability of the measurement and more accurately adjust for baseline in their analysis of the psychophysiological response to stress. Notably, the later studies did not find any significant differences in resting values or reactivity to stress between the two groups of IPV perpetrators.

Studies by Romero-Martínez et al. [5,6] have attempted to build on the results of Gottman et al. [10] by employing several cardiovascular and electrodermal markers that were not employed in previous studies in this field of research. Specifically, they compared the ANS response to a modified version of the Trier Social Stress Test (TSST) in IPV perpetrators described as reactive, based on their criminal record and psychological characteristics, and non-violent men. In the procedure, participants had to make a speech about their own experiences and problems with IPV and give their opinions about Spanish legislation, followed by a mental arithmetic test. In this study, IPV perpetrators showed an increase in their skin conductance level (hyperreactivity) when they prepared to confront the stress after researchers had presented the task instructions (preparatory period), and this hyperreactivity was associated with impulsivity traits. In addition, they had higher HRs, lower vagal ratios, and higher non-specific skin conductance responses (NSCRs) after the stressor ended (recovery period) than controls. Finally, they showed shorter pre-ejection period (PEP; higher sympathetic predominance) than controls throughout the assessment.

The sympathetic predominance observed may be indicative of ANS dysregulation. In this regard, individuals with this psychophysiological profile maintain high levels of vigilance (or activation), irritability, and tension (negative affect) over sustained periods of time. This dysregulation could reduce the threshold for violent behavior when exposed to certain types of stimuli that are incongruent with their hostile cognitive schemas, such as sexist ideas about women or dominant roles in relationships [13]. Additionally, the facilitation of violence might also be explained by IPV perpetrators' cognitive processing deficits, which may include low processing speed and poor attention switching and sustained attention, as well as deficits in working memory and other impairments associated with executive dysfunctions, such as poor cognitive flexibility, planning abilities, and inhibitory control [14–18].

Gottman et al. [10] and later studies [11,12] neglected the role of chronic alcohol abuse in the development of cognitive impairments [16–23] and ANS dysregulation [24–26] in this kind of population, as well as the fact that this dysregulation entails an abnormal stress response. In fact, it has been suggested that chronic alcohol consumption tends to depress the central nervous system, suppressing excitatory nerve pathway activity in the resting state [27], but there are inconsistencies about whether alcohol tends to reduce sympathetic or parasympathetic control of the ANS [28–33]. Thus, it makes sense to study how alcohol disrupts IPV perpetrators' response to stress.

The present study sought to confirm and extend the results of Romero-Martínez et al. [5,6], while including some changes in the experimental procedure and increasing the sample size, in order to improve our understanding of the complex phenomenon of IPV. Specifically, the first objective of this study was to analyze reactive IPV perpetrators' psychological (trait and state) and physiological responses to a set of cognitive tests, namely, an acute laboratory stressor previously shown to produce psychophysiological activation [34,35], compared to a non-violent group (controls). Based on the results of Romero-Martínez et al. [5,6], we expected that reactive IPV perpetrators would present higher sympathetic predominance and lower vagal regulation in response to acute stress than controls. Moreover, an additional group of IPV perpetrators with high-risk alcohol use was included to compare their ANS response to that of the low-risk alcohol use IPV perpetrators and the non-violent group. Because chronic heavy alcohol consumption has a depressive effect on ANS activity and is associated with higher levels of the impulsivity trait [28–33], we hypothesized that IPV perpetrators who were heavy drinkers would, due to the effects of alcohol, show lower sympathetic predominance and higher vagal regulation in response to stress than IPV perpetrators with low alcohol consumption. This type of research seeks to help us improve our understanding of emotional and psychophysiological dysregulation in IPV perpetrators, which may underlie their predisposition to violence.

2. Materials and Methods

2.1. Participants

The final sample was composed of 95 men who participated voluntarily in the study: 27 IPV perpetrators who were heavy drinkers (see definition below), 33 IPV perpetrators who were not heavy drinkers, and 35 non-violent men with no history of violence as the control group. The IPV perpetrators were recruited from the community psychological and psychoeducational treatment program, CONTEXTO, carried out in the Department of Social Psychology of the University of Valencia (Spain). This is a court-mandated program for men who were sentenced to less than 2 years in prison for violence against women in intimate relationships, but had no previous criminal record, and therefore, had received a suspended sentence on the condition that they attend this intervention program [36–38].

Initial inclusion criteria for IPV perpetrators were as follows: having been sentenced to prison for IPV (less than 2 years in prison); not having been convicted of assault outside the home, in order to analyze the specific profile of IPV perpetrators (excluding those IPV perpetrators who presented generalized aggression); and not being diagnosed with any mental illness. Candidates continued to be eligible to participate if the qualitative interviews and Symptom Checklist-90-Revised (SCL-90-R) scores confirmed that they were free of mental illness. Use of alcohol, tobacco, and other drugs (cannabis, MDMA, heroin, and cocaine) was also registered. We then included IPV perpetrators who reported an alcohol intake of 30 g/day or more [39–41] and had four or more symptoms of alcohol use disorder (AUD) listed in the DSM-5 [42], forming the group of high alcohol users (HAs). In addition, those who reported an intake of less than 30 g/day and had less than two DSM-5 symptoms of AUD were classified as low alcohol users (LAs), whereas other IPV perpetrators were excluded. Moreover, we also checked that the participants (IPV perpetrators and controls) did not abuse other drugs, such as cannabis, MDMA, heroin, and cocaine, and presented less than two DSM-5 symptoms of substance use disorder (SUD).

Controls were recruited through mailings and advertisements. Inclusion criteria were as follows: having similar socio-demographic characteristics to the experimental groups (no significant differences in age, nationality, marital status, level of education, employment status, or income level; Table 1), alcohol consumption of less than 30 g/day and less than two DSM-5 symptoms of AUD, and not having been convicted of IPV, verified by a criminal record certificate attesting to the fact that they had no history of violence. Moreover, it has been suggested that scores equal to or above 11 on the conflict tactics scale-2 (CTS-2) are indicators of IPV, despite never having been convicted (Cohen et al. [43]). The control group included in our study reported lower CTS-2 scores on psychological abuse (1.50 ± 1.38), physical assault (0.13 ± 0.43), and sexual abuse (0.83 ± 1.05).

Table 1. Mean ± SD of descriptive characteristics for all groups (* $p < 0.05$).

Variable	IPV Perpetrators		Control (n = 35)	η_p^2
	High Alcohol (n = 27)	Low Alcohol (n = 33)		
Age (years)	40.07 ± 12.10	39.84 ± 10.09	42.14 ± 10.94	0.080
Body mass index (BMI) (kg/m^2)	22.44 ± 3.80	24.15 ± 3.41	24.46 ± 4.74	0.043
Nationality				0.079
Spanish	22 (81.48%)	26 (78.78%)	28 (80%)	
Latin Americans	3 (11.11%)	3 (9.09%)	5 (14.26%)	
Africans	2 (7.41%)	4 (12.13%)	0 (0%)	
Marital status				0.086
Single	10 (37.03%)	11 (33.33%)	16 (45.71%)	
Married	5 (18.52%)	9 (27.28%)	14 (40.00%)	
Separate/Divorced/Widowed	12 (44.45%)	13 (39.39%)	5 (14.28%)	
Number of children	0.80 ± 1.30	1.67 ± 2.08	0.86 ± 0.97	0.048
Level of education				
Primary/lower secondary	20 (70.07%)	16 (48.48%)	14 (40%)	
Upper secondary/vocational training	6 (22.22%)	15 (45.45%)	18 (51.43%)	
University	1 (2.70%)	2 (6.07%)	3 (8.57%)	
Employment status				0.065
Employed	12 (44.50%)	14 (43.75%)	15 (42.86%)	
Unemployed	15 (55.50%)	19 (59.37%)	20 (57.14%)	
Income level				0.063
1800 €–12,000 €	14 (51.86%)	13 (39.39%)	21 (60%)	
>12,000 €–30,000 €	12 (44.44%)	16 (48.49%)	12 (34.28%)	
>30,000 €–90,000 €	1 (3.70%)	4 (12.12%)	2 (5.72%)	
Age at start of alcohol consumption	16.35 ± 2.16	18.10 ± 5.16	17.06 ± 3.02	0.035
Amount of alcohol consumption per day [1,*]	64.65 ± 8.32	9.41 ± 11.15	6.23 ± 7.90	0.260
Time of alcohol abstinence (months)	0.34 ± 0.79	1.44 ± 3.40	0.69 ± 3.35	0.080
Cigarettes/day	11.74 ± 9.04	12.76 ± 10.84	8 ± 6.41	0.046
Fagerström test	3.94 ± 2.10	4.31 ± 3.59	3.36 ± 2.76	0.670
Criminal records other than IPV				0.87
No	28 (84.85%)	21 (84%)	-	
Yes	1 (3.03%)	0 (0%)	-	
Yes, but no violence	4 (12.12%)	4 (16%)	-	
Time of sentencing (months)	9.81 ± 6.52	11.90 ± 8.89	-	0.93

[1] Differences between intimate partner violence (IPV) perpetrators with high alcohol use and IPV perpetrators with low alcohol use and between IPV perpetrators with high alcohol use and controls. Note: Percentages may not add up to exactly 100%, owing to the rounding off.

All participants were right-handed and healthy, lived in Valencia (Spain), were properly informed about the research protocol, and gave their written informed consent. The research was conducted taking into account current ethical and legal guidelines on the protection of personal data and research with human beings, in accordance with the Declaration of Helsinki, and it was approved by the Ethics Committee of the University of Valencia (H1348835571691).

2.2. Procedure

All participants attended three consecutive sessions at the Faculty of Psychology of the University of Valencia. In the first session, participants were interviewed to exclude those with organic diseases, and socio-demographic data were collected through a semi-structured interview. Then, participants were asked about their consumption of alcohol, tobacco, and other drugs (cannabis, MDMA, heroin, and cocaine). Subsequently, they completed an inventory based on the DSM-5 to check for the presence of AUD, and the Fagerström Test of Nicotine Dependence to assess their addiction level.

In the second session, participants carried out the laboratory cognitive task, which consists of a set of traditional neuropsychological tests and the computer-based Cambridge Neuropsychological Test Automated Battery (CANTAB). During the entire session, which lasted approximately 60 min, electrodermal activity and cardiorespiratory system activity were continuously recorded with the Vrije Universiteit Ambulatory Monitoring System (VU-AMS), using the corresponding Data Analysis and Management Software (DAMS). For later analyses, the recordings were divided into four periods: resting, preparatory, task, and recovery. In each period, the following were measured: skin conductance level (SCL), HR, respiratory rate (RR), pre-ejection period (PEP), the high frequency component (HF) of heart rate variability, and respiratory sinus arrhythmia (RSA). In addition, pre- and post-session assessments were carried out using the Positive and Negative Affect Schedule (PANAS).

In the third session, a battery of psychological trait variables were assessed using the Frontal Systems Behavior Scale (FrSBe) and Plutchik's Impulsivity Scale. At the end of this session, participants were paid €50 for their participation.

2.3. Electrodermal and Cardiorespiratory Recording

The VU-AMS used to record physiological data requires seven electrodes. As recommended by the developers of the system, we used a Kendall ARBO H98SG (Covidien products, Dublin, Ireland) single use electrocardiography (ECG) electrode with Wet Gel for the impedance cardiography and ECG, and the Biopac TSD203 combined with isotonic electrode gel (GEL101) for skin conductance, which was recorded from the medial phalanges of the index and middle or ring finger. A blue lead wire connector with seven lead wires and a yellow connector were used for the recording of the ECG and SCL, respectively. An infrared interface cable connected the ambulatory recording device (VU-AMS*5fs*) to the monitoring computer. For memory, we used a 4-GB Ultra Compact Flash external memory card from SanDisk (SDCFHS-004G-G46) and a compact flash card reader to extract the VU-AMS data from the Compact Flash card. Lastly, the Data Analysis and Management Software (DAMS) was used for VU-AMS device configuration and data manipulation.

The markers used to assess ANS activity were SCL, habitually used as the main marker for emotional arousal; HR in beats per minute (bpm) and RR in breaths per minute (breath/pm) as two general physiological activation markers; the PEP index of contractility measured in milliseconds (msec) as a marker of sympathetic activity; and, finally, two markers of parasympathetic activity, namely, the HF power as a component of the heart rate variability signal (equivalent to the 0.15-0.40 Hz band) and the RSA value measured in milliseconds (msec) [44–46].

2.4. Psychological Measures

Positive and Negative Affect Schedule (PANAS): this is a self-report questionnaire composed of two scales: positive and negative affect. Each subscale is composed of 10 items that participants respond to according to how they feel at the time of the assessment. Items are rated on a Likert scale from 1 (not at all) to 5 (very much) [47,48]. Cronbach's alpha was 0.78 for the positive affect scale and 0.82 for the negative affect scale.

Frontal Systems Behavior Scale (FrSBe): this is a 46-item behavior rating scale that was developed as a measure of behavior associated with damage to the frontal system of the brain. Index scores assess executive dysfunction, disinhibition/emotional dysregulation, and apathy. Participants rated their behaviors on a 5-point Likert-type scale. In this study, we used the Spanish version of the FrSBe [49,50]. Cronbach's alpha was 0.84.

Plutchik's Impulsivity Scale: impulsivity traits were assessed using the Spanish version of Plutchik's Impulsivity Scale [51,52]. This scale is composed of 15 items rated on a Likert-type scale with four response options (never, sometimes, often, and almost always), scored from 0 to 3 (respectively).

It is possible to calculate four subscales: self-control, planning, physiological behavior control, and spontaneous attitudes. Cronbach's alpha was 0.67.

2.5. Data Analysis

The normality of the data distribution was explored using the Shapiro-Wilk test. After confirming the normality of the data, analysis of variance (ANOVA) was carried out to detect significant differences between groups in age, body mass index, number of children, age of starting alcohol consumption, abstinence time, nicotine consumption, nicotine dependence, criminal record for reasons other than IPV, length of sentence, personal satisfaction, internal and external locus of control, the participant's cooperation, frustration tolerance, and questionnaire scores. In addition, chi-square tests were performed for categorical variables such as socio-demographic characteristics (nationality, marital status, level of education, employment status, etc.).

To examine group effects on psychological and physiological variables, a repeated-measures ANOVA was conducted with 'period' as the within-participant factor (at two time points in the case of psychological variables: pre-session and post-session; and at four time points for the physiological variables: resting, preparatory, task and recovery) and 'group' as the between-participant factor. The Greenhouse-Geisser correction for degrees of freedom was applied where appropriate. For significant results, partial eta-squared was reported as a measure of effect size ($\eta_p{}^2$). Based on a previous study, a partial eta-squared of around 0.01 was considered a small effect, around 0.06 a medium effect, and greater than 0.14 a large effect [53].

The areas under the curve with respect to the increase (AUCi) and ground (AUCg) were calculated using the trapezoidal formula [54] to analyze the magnitude of the responses to the task in electrodermal and cardiorespiratory variables. The AUCi was calculated with reference to the resting value, ignoring the distance from zero for all measurements and emphasizing changes over time, whereas the AUCg, the total area under the curve, was used to assess the distance of these measurements from the ground. Univariate ANOVA was used to examine group effects in AUCi and AUCg, and the Bonferroni post hoc test was then employed to determine the direction of the differences between the groups.

Data analyses were carried out using IBM SPSS Statistics for Windows, Version 22.0 (Armonk, NY, USA). In this study, p values < 0.05 were considered statistically significant. Average values are reported in tables as mean $\pm$ SD.

3. Results

3.1. Participants' Characteristics

Groups did not differ in anthropometric or socio-demographic characteristics (see Table 1). Participants differed on their rates of alcohol use (see Table 1), but they did not differ on the use of other drugs, such as cannabis, MDMA, heroin, and cocaine. Furthermore, no differences were found in psychophysiological parameters measured during the resting period. Nevertheless, there were significant differences in the FrSBe total score ($F(2, 92) = 3.36$, $p = 0.04$, $\eta^2_p = 0.086$), executive dysfunction ($F(2, 92) = 4.53$, $p = 0.014$, $\eta^2_p = 0.086$), and disinhibition ($F(2, 92) = 4.64$, $p = 0.012$, $\eta^2_p = 0.086$), with IPV perpetrators with high alcohol use obtaining higher scores than controls ($p < 0.05$). Moreover, there were differences in impulsivity (physiological behavior control) ($F(2, 92) = 3.89$, $p = 0.024$, $\eta^2_p = 0.086$) and impulsivity (planning skills) ($F(2, 92) = 15.96$, $p < 0.01$, $\eta^2_p = 0.241$), with IPV perpetrators with high alcohol use scoring lower on physiological behavior control and planning skills than controls ($p < 0.05$).

3.2. Stress Responses

3.2.1. Psychological State Profiles and Appraisal Scores

Significant 'period' effects were found for PANAS positive and negative affect ($F(1, 93) = 13.28$, $p < 0.01$, $\eta_p^2 = 0.125$ and $F(1, 93) = 9.71$, $p = 0.002$, $\eta_p^2 = 0.095$, respectively), with all groups showing large decreases in their positive scores and increases in negative scores after the stressor ended ($p > 0.05$). Nevertheless, a significant 'period x group' interaction effect was only found for PANAS positive affect ($F(2, 91) = 3.47$, $p = 0.035$, $\eta_p^2 = 0.071$), with both groups of IPV perpetrators showing larger decreases than controls, although these differences were not significant.

Regarding appraisal, differences were observed in satisfaction ($F(2, 88) = 16.41$, $p = 0.005$, $\eta^2{}_p = 0.270$) as well as in the internal and external locus of control ($F(2, 88) = 5.64$, $p = 0.005$, $\eta^2{}_p = 0.126$ and $F(2, 88) = 5.64$, $p = 0.005$, $\eta^2{}_p = 0.126$, respectively), with both groups of IPV perpetrators obtaining lower satisfaction scores ($p < 0.001$ in both cases) and higher external locus of control scores than controls ($p < 0.05$ in both cases). Moreover, the groups differed in the evaluator's perception of the participants' cooperation ($F(2, 88) = 6.00$, $p = 0.004$, $\eta^2{}_p = 0.125$) and frustration tolerance ($F(2, 88) = 10.10$, $p < 0.001$, $\eta^2{}_p = 0.219$). Both groups of IPV perpetrators (HA and LA) obtained lower scores on cooperation ($p = 0.006$) and tolerance to frustration than controls ($p < 0.001$) (see Table 2).

Table 2. Mean ± SD of psychological measures for all groups (* $p < 0.05$).

Variable	IPV Perpetrators			
	High Alcohol (n = 27)	Low Alcohol (n = 33)	Control (n = 35)	η_p^2
PANAS Positive affect [1,*]				
Pre	29.22 ± 8.88	29.61 ± 6.76	28.89 ± 7.45	0.125
Post	25.81 ± 9.35	26.03 ± 8.53	28.69 ± 8.01	0.710
Negative affect [1]				
Pre	13.59 ± 3.51	12.70 ± 3.07	12.43 ± 2.33	0.095
Post	12.19 ± 2.74	12.06 ± 2.79	11.43 ± 2.52	0.125
Appraisal				
Satisfaction [2]	6.37 ± 1.20	6.57 ± 1.46	8.06 ± 1.11	0.270
Internal locus of control [2]	7.22 ± 1.62	7.19 ± 1.62	8.11 ± 0.96	0.126
External locus of control [2]	2.78 ± 1.62	2.81 ± 1.19	1.89 ± 0.96	0.126
Cooperation [2]	4 ± 0.69	4.17 ± 0.65	4.57 ± 0.60	0.125
Frustration tolerance [2]	3.05 ± 0.86	3.31 ± 0.76	3.89 ± 0.58	0.219
Frontal System Behavior Scale				
Executive dysfunction [3]	43.42 ± 10.51	36.57 ± 8.11	37.81 ± 7.72	0.086
Disinhibition [3]	41.79 ± 11.96	35.27 ± 9.85	34.34 ± 7.14	0.086
Impulsivity Scale				
Self-Control	5.30 ± 2.90	4.27 ± 2.94	5.88 ± 2.88	0.234
Planning deficits [3]	8.74 ± 1.94	8.28 ± 2.15	5.54 ± 2.63	0.241
Physiological behaviors control [3]	0.63 ± 0.92	0.79 ± 1.11	1.30 ± 0.91	0.086
Spontaneous attitude	3.19 ± 1.38	2.82 ± 1.86	3 ± 1.87	0.655

IPV: intimate partner violence. [1] Differences between pre and post scores in all three groups. [2] Differences between IPV perpetrators (both groups) and control. However, no differences were found between IPV perpetrators with high and low alcohol consumption. [3] Differences between IPV perpetrators with high alcohol and controls.

3.2.2. Electrodermal and Cardiorespiratory Responses

The cognitive task carried out in this study was effective in eliciting electrodermal and cardiorespiratory responses because significant effects of 'period' on the SCL, RR, HR, PEP, HF, and RSA were found in the total sample: $\varepsilon = 0.61$, $F(1.82, 168.05) = 22.96$, $p < 0.001$, $\eta_p^2 = 0.20$, $\beta = 1$; $\varepsilon = 0.69$, $F(2.08, 191.71) = 85.56$, $p < 0.001$, $\eta_p^2 = 0.48$, $\beta = 1$; $\varepsilon = 0.94$, $F(2.82, 265.20) = 5.97$, $p = 0.001$, $\eta_p^2 = 0.06$, $\beta = 0.94$; $\varepsilon = 0.70$, $F(2.09, 197.34) = 110.15$, $p < 0.001$, $\eta_p^2 = 0.54$, $\beta = 1$; and $\varepsilon = 0.77$,

F(2.33, 214.43) = 13.76, $p < 0.001$, $\eta_p^2 = 0.13$, β = 0.99, respectively. Analyzing each group separately, intra-group comparisons revealed significant effects of 'period' in LA IPV perpetrators on SCL: $\varepsilon = 0.48$, F(1.44, 37.51) = 12.14, $p < 0.001$, $\eta_p^2 = 0.32$, β = 0.97; HR, $\varepsilon = 0.83$, F(2.50, 65.24) = 24.38, $p < 0.001$, $\eta_p^2 = 0.48$, β = 1; RR, $\varepsilon = 0.61$, F(1.83, 264.46) = 3.89, $p = 0.029$, $\eta_p^2 = 0.10$, β = 0.66; and PEP, $\varepsilon = 0.96$, F(2.88, 92.15) = 3.63, $p = 0.017$, $\eta_p^2 = 0.10$, β = 0.77, respectively. Moreover, in HA IPV perpetrators and controls, there was a significant 'period' effect on: SCL, $\varepsilon = 0.65$, F(1.97, 63.22) = 10.04, $p < 0.001$, $\eta_p^2 = 0.24$, β = 0.98, and $\varepsilon = 0.41$, F(1.23, 42.03) = 4.09, $p = 0.041$, $\eta_p^2 = 0.10$, β = 0.83, respectively; HR, $\varepsilon = 0.59$, F(1.78, 57.24) = 28.78, $p < 0.001$, $\eta_p^2 = 0.47$, β = 1, and $\varepsilon = 0.62$, F(1.86, 63.44) = 35.08, $p = 0.041$, $\eta_p^2 = 0.50$, β = 1, respectively; HF, $\varepsilon = 0.74$, F(2.22, 71.20) = 25.10, $p < 0.001$, $\eta_p^2 = 0.44$, β = 1, and $\varepsilon = 0.77$, F(2.32, 78.88) = 49.65, $p < 0.001$, $\eta_p^2 = 0.59$, β = 1, respectively; and RSA, $\varepsilon = 0.88$, F(2.66, 69.32) = 7.28, $p < 0.001$, $\eta_p^2 = 0.21$, β = 0.96, and $\varepsilon = 0.84$, F(2.52, 85.80) = 6.08, $p = 0.002$, $\eta_p^2 = 0.15$, β = 0.92, respectively. In all the groups, SCL, HR, and RR increased from resting to the preparatory period, and from the preparatory period to the tasks, then decreased until recovery. Moreover, in all groups, the PEP shortened from resting to the task period, and then lengthened until recovery. Conversely, parasympathetic markers (HF and RSA) decreased from resting to the tasks and then increased until recovery.

3.2.3. Differences between Groups in Electrodermal and Cardiorespiratory Variables in Response to a Set of Cognitive Tests

A significant 'period × group' interaction was found for SCL (F(4.18, 192.29) = 2.09, $p = 0.05$, $\eta_p^2 = 0.44$, $\beta = 0.75$) and RR (F(5.19, 238.84) = 3.86, $p = 0.002$, $\eta_p^2 = 0.07$, $\beta = 0.95$). In fact, LA IPV perpetrators scored higher than controls during the preparatory and recovery periods ($p < 0.05$ in both cases). Additionally, LA IPV perpetrators presented higher RR values during the preparatory, task, and recovery periods than HA IPV perpetrators and controls ($p < 0.001$ in all cases) (see Figure 1).

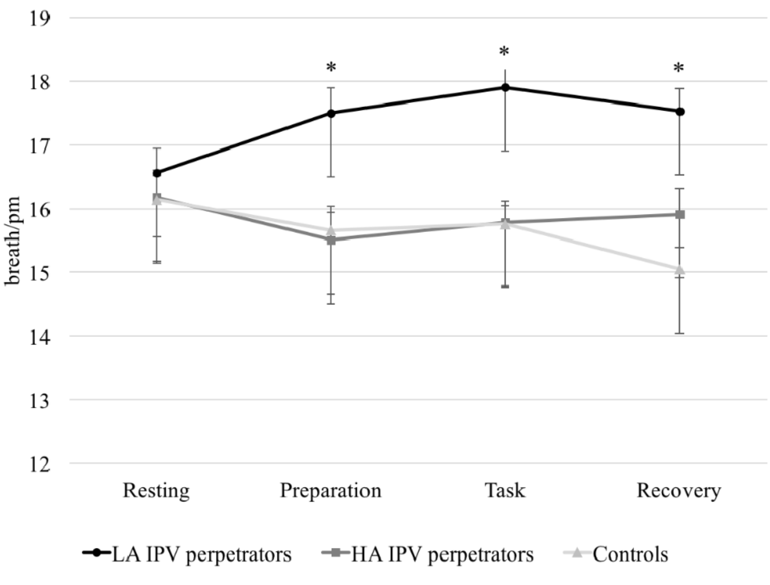

Figure 1. Respiratory rate (RR) (breath//pm) in response to acute stress (with different levels of alcohol consumption) and controls (* $p < 0.05$). LA: low alcohol; HA: high alcohol.

Finally, there was a significant 'group' effect for SCL (F (2, 92) = 3.62, $p = 0.030$, $\eta_p^2 = 0.07$, $\beta = 0.66$), and RR (F(2, 92) = 11.49, $p < 0.001$, $\eta_p^2 = 0.20$, β = 0.99), with LA IPV perpetrators showing higher SCL and RR than controls ($p = 0.025$ and $p < 0.001$, respectively). Moreover, differences were found between groups in the AUCg for SCL (F(2, 92) = 3.51, $p = 0.034$, $\eta_p^2 = 0.07$, $\beta = 0.64$) and RR (F(2, 92) = 9.75, $p < 0.001$, $\eta_p^2 = 0.27$, $\beta = 0.65$), with LA IPV perpetrators showing higher values than controls ($p = 0.029$ and $p = 0.030$). Furthermore, LA IPV perpetrators also had a higher RR AUCg than HA IPV perpetrators ($p < 0.001$) (see Figure 2).

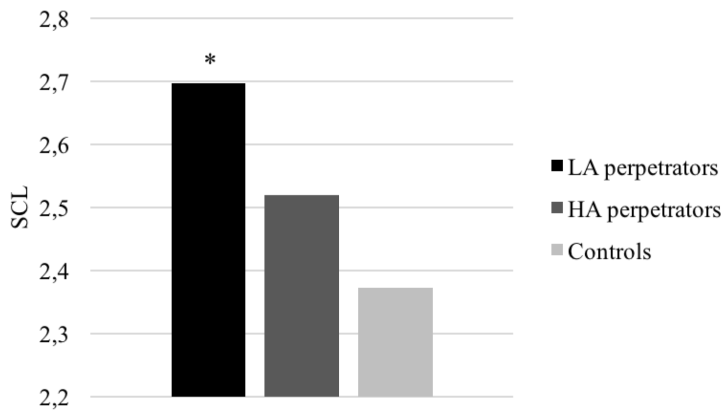

Figure 2. Skin conductance level (SCL) average in response to acute stress for IPV perpetrators (with different levels of alcohol consumption) and controls (* $p < 0.05$).

No significant effects of 'period × group' or 'group' were observed for HR, PEP, HF, or RSA. Furthermore, there were no differences in the AUCi or AUCg in these variables.

4. Discussion

The aim of this study was to analyze the profile and psychological (state) and ANS (electrodermal and cardiorespiratory) response to a set of cognitive tests in two groups of IPV perpetrators with different levels of alcohol consumption, compared to non-violent individuals (controls). The present study found that IPV perpetrators (both groups) scored higher on self-reported executive dysfunctions and impulsivity (poor self-control, planning abilities, and physiological behavior control) than controls. Additionally, both groups of IPV perpetrators showed larger decreases in positive affect, less satisfaction, and a higher external locus of control than participants in the control group after the tasks ended. Regarding the psychophysiological variables, our data also demonstrated that LA IPV perpetrators presented higher SCL and RR reactivity than controls, especially during preparatory, task, and recovery periods. Nevertheless, no differences were found between groups in HR, RSA, or PEP. Finally, it should be noted that the majority of the differences between groups presented a moderate to large effect size.

The laboratory task, which can be considered a cognitive stressor and has previously been validated in clinical and normative populations employing hormonal, immunological, and psychophysiological parameters [34,35], proved to be effective in modifying emotionality and the psychophysiological state in our study. All the participants showed a significant decrease in positive affect, increases in SCL, HR, and RR, and shortening of the PEP from resting to the task periods. Furthermore, the finding of a preparatory increase in psychophysiological parameters replicates the results of previous research in which participants were confronted with different laboratory tasks involving auditory or gustatory stimuli or recognition of human faces [13]. The preparatory period is associated with increases in sympathetic activation (shorter PEP values), and this is normally followed by a decrease until the recovery period and increases in parasympathetic activation (higher HF and RSA values) [55], as we found in both IPV perpetrator groups and the non-violent controls. On the other hand, the pattern for coping with stress differed between violent and non-violent groups, but without differences between IPV perpetrators according to alcohol intake. In fact, all the IPV perpetrators rated their cognitive performance in front of a committee more negatively than controls (although we did not offer real feedback on their performance). Moreover, they attributed their performance to external factors, unlike controls, who assumed that they had control over their performance on the laboratory tasks. These results in IPV perpetrators may reflect low self-esteem and insecurity. Thus, this different way of coping with stress (different attribution) may offer an explanation for the impact of novelty on psychophysiological regulation in IPV perpetrators. However, psychophysiological differences were marked in LA IPV perpetrators and controls, but not in HA IPV perpetrators. Below, we will discuss a possible explanation for these differences or lack of them.

We initially hypothesized that reactive IPV perpetrators would show a sympathetic predominance and lower vagal activation in response to stress, especially individuals with lower alcohol consumption [5,6,26]. Specifically, impulsive IPV perpetrators tend to be characterized by an 'electrodermal lability', which entails sustained sympathetic activation (shorter PEP and lower vagal values), even when the stressor has ended [5,6,13]. Even though IPV perpetrators had higher self-reported executive deficits and impulsivity traits than controls (with no differences between IPV perpetrators with different levels of alcohol consumption), our data did not support the idea of a sympathetic predominance in impulsive IPV perpetrators. A possible reason for the lack of differences between groups in psychophysiological parameters could be the stressor employed. Previous research [5,6] employed a psychosocial stressor (TSST) with an emotionally charged topic for IPV perpetrators. However, the present study employed a purely cognitive stressor that is not designed to activate an emotional response in any particular group and does not interfere with or explain abnormal psychophysiological activation in IPV perpetrators. Thus, our study indicates that it would be necessary to conduct additional studies that present IPV perpetrators with different types of stimuli in order to discover whether this type of aggressor demonstrates a different/specific pattern of psychophysiological activation, or whether the activation depends on the stimulus/stressor presented.

Romero-Martínez et al. [6] concluded that impulsive IPV perpetrators showed higher general activation/arousal (HR and NSCR values) during the recovery period, but differences were only observed between LA IPV perpetrators and controls in breathing intervals (RR). Because both HR and RR may contribute considerably to HRV regulation, and there is complex feedback between the two parameters [56,57], we think our results partially agree with previous research. Moreover, our data support the view that arousal is heightened in impulsive individuals [58] because LA IPV perpetrators, who scored higher on impulsivity traits, presented higher SCL than controls.

Regarding the effects of alcohol on psychophysiological activation, our study found higher sympathetic activation in LA IPV perpetrators during the task and recovery periods than during the resting period, and this pattern was not found in HA IPV perpetrators or controls. In addition, higher activation of the parasympathetic system was found in the recovery period than in the preparatory period only in the HA group and controls. These results are partially congruent with the hypothesis that alcohol plays a core role in IPV perpetration [14,59–61], with alcohol consumption buffering the ANS response in this group of violent men with high alcohol consumption. Alcohol acts as a depressor of the ANS, but it is related to heightened sympathetic activation in individuals who present low alcohol consumption. Furthermore, we employed a neutral laboratory stressor without a clear emotional valence directly associated with IPV stimuli, unlike previous studies. Nevertheless, although our study showed higher activation of LA IPV perpetrators, specifically during the recovery period when the stressor had ended, it did not offer certainty about how alcohol disrupts ANS regulation, thus predisposing the individual to aggressive behavior. Tentative explanations for the lack of significant results can be provided. First, the criterion employed to classify the sample, namely, alcohol abuse, although previously employed and validated [39–41], has not been used in previous research on IPV perpetrators. Second, there is no clear understanding of what amount of alcohol or how many years of sustained alcohol consumption are necessary to disrupt ANS regulation [27–29,62]. Moreover, it is not clear whether ANS disruptions can be exclusively explained by acute alcohol consumption, rather than chronic use, without consumption during the research conducted. Additionally, future research should consider specific personality traits, such as antisocial, borderline, narcissistic, and dependent traits, which tend to present a direct association with alcohol misuse [59,63,64], in order to study how they affect the ANS response to stress. Finally, our sample is relatively young, and the participants had not been clinically diagnosed with AUD. Overall, further research is needed to clarify the ANS disruption associated with alcohol consumption, and whether IPV perpetrators present a different pattern of ANS activation when faced with stimuli with different emotional valences.

This study is part of an ongoing research effort to improve our understanding of why IPV perpetrators use violence against their partners. Even though the present study provides important information that improves our understanding of factors predisposing men to IPV, several limitations should be recognized. First, the modest sample size and the cross-sectional nature of our study could make it difficult to generalize the results obtained. Hence, further studies should be performed with a larger sample size and including other types of IPV perpetrators, such as those with generalized aggression and/or other types of antisocial behaviors, to find out whether our results can be replicated. Another limitation is the absence of a non-violent alcoholic control group. However, it is quite difficult to identify a group of alcoholic men who are still consuming alcohol and agree to voluntarily participate in research. Finally, the fact that the control group is IPV-free could not be verified because we do not have their partners' reports. Nonetheless, our data are novel because no studies have examined electrodermal and cardiorespiratory responses to an acute laboratory stressor in IPV perpetrators.

5. Conclusions

The present study extends previous psychophysiological research in this field, allowing to us to extend our knowledge about how perpetrators' ANS reacts to different stressful situations. This study was conducted as an effort to simulate daily life situations (marital conflict, psychosocial stress, cognitive stress, etc.) and understand how IPV perpetrators cope with acute stress, with the aim of developing specific interventions to improve their self-regulation. Even though we are in the early stages of developing this type of rehabilitation strategy, neurofeedback seems to offer the possibility to reduce impulsivity and improve behavioral inhibition. Moreover, the analysis of these psychobiological variables, along with neuropsychological assessments, could be used to define perpetrator typologies, which, in turn, would make it possible to develop more specific prevention and intervention programs [63–68]. Hence, in-depth knowledge about ANS regulation in IPV perpetrators could help to develop methods to use as adjuvants to current psychotherapy. For example, neurofeedback training could be used to increase batterers' behavioral self-regulation and, in turn, increase adherence to rehabilitation interventions and reduce the risk of IPV recidivism in the long term.

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Emotional and autonomic dysregulation in abstinent alcoholic men: An idiosyncratic profile?

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Abstract:	Men who misuse alcohol seem to present a dispositional tendency to negative affect, which may entail difficulties regulating emotions to cope effectively with high stress or anxious situations, increasing the risk of relapsing in alcohol consumption. This dysphoric state in alcoholic abusers usually implies the existence of alexithymia, which compromise the abilities to acknowledge, recognize and regulate emotional states. A psychophysiological correlate of this emotional dysregulation in men who misuse alcohol is the reduction of parasympathetic activation to control heart rate variability during stressful and/or conflict situations. Hence, the main aim of this study was to investigate whether long-term abstinent alcoholic men (LTAA) would exhibit a predominance of negative affect and sympathetic activation (cardiovascular and electrodermal) in response to an acute laboratory standarized stressor from non-alcoholic group. Moreover, there is also hypothesized that as higher as alexhytimia traits, higher increase of negative affect and sympathetic activation in response to stress, especially in LTAA group. Our data demonstrated that LTAA group experienced slight increases in anxiety and anger state and a moderate worsening of mood in comparison with controls. Moreover, they also exhibited lower HF and RSA values, shorter PEP values and higher RR than controls. Finally, alexithymic traits implies higher worsening of mood and sympathetic predominance (shorter PEP values and magnitude of response), being these associations stronger in LTAA group. These findings point out a different emotional and cardiovascular pattern in response to psychosocial stress in LTAA when compared with non-alcoholic men. Hence, a wider knowledge of how reacts to stress this specific population may offer valuable information to identify risk factors for relapse in alcohol misuse.
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