



TRABAJO FIN DE MÁSTER

**An Examination of Different Etiological  
Pathways to Alcohol Use and Misuse in  
Adolescence**

MÁSTER EN INVESTIGACIÓN EN CEREBRO Y CONDUCTA

**UNIVERSIDAD JAUME I**

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## Abstract

**Introduction:** Alcohol abuse, especially among adolescents, causes important health, economic and social problems. Different theoretical pathways have been suggested for the etiology of alcohol use and abuse. The aim of our study was to describe some of these different etiological pathways in adolescents. We explored the importance and specific role of personality, cognitive variables (motives and drinking refusal self-efficacy under social pressure) and environmental variables (anti-normative behavior of friends) in each etiological pathway. **Method:** We assessed in a sample of 201 high school students (47.3% females; mean age 15,41 years; SD = 1,124) the influence of these variables. **Results:** structural equation modelling showed the co-occurrence of 4 main etiological pathways: coping motives fully mediated the association between neuroticism and alcohol-related problems (*negative affect regulation pathway*), extraversion was linked to alcohol use at the weekend and alcohol-related problems through social drinking motives (*positive affect regulation pathway*), extraversion and low agreeableness was related to drinking at the weekend, alcohol-related problems and motives through anti-normative behavior of friends (*deviance proneness pathway*); finally, low extraversion, low neuroticism and conscientiousness was negatively associated with alcohol use and abuse through a greater drinking refusal self-efficacy in front of social pressure (*force of will pathway*). **Conclusions:** We observed the relevance of distal (personality domains) and more proximal variables (anti-normative behavior of friends, drinking refusal self-efficacy-social pressure and motives) in adolescent alcohol use and abuse, illustrating the complex interplay of these factors.

**Keywords:** Personality, Deviant Peers, Drinking Refusal Self-Efficacy-Social Pressure, Drinking Motives, Alcohol, Etiological Pathways, Force of Will.

## Introduction

Alcohol is the most commonly used drug in the world, and its abuse, especially among adolescents, produces important health, economic and social problems (Goldman et al., 2005). Alcohol consumption is causally related to more than 60 different medical conditions, and is estimated to be the world's third largest risk factor for disease and disability, see Table 1 (World Health Organization, 2011; Room, Babor & Rehm, 2005). Alcohol use and abuse is also one of the major causes of DALYs (disability-adjusted life years). In 2012, 139 millions of DALYs were caused by alcohol consumption (OMS, 2014). In Spain, alcohol abuse is the fourth cause of DALYS in adult men (Gènova-Maleras, Álvarez-Martín, Morant-Ginestar, Fenández de Larrea-Baz & Catalá-López, 2012). It has been estimated too that alcohol use is the eighth cause of deaths in the world (5.9%) produced in 2012 (OMS, 2014). Specifically, 95000 men and 25000 women lost their lifes for alcohol consumption in the EU in 2004 (Shield, Kehoe, Gmel, Rehm, & Rehm, 2012). In Spain, around 8% of all deaths are due to the effects of this substance (10% men and 5% women) (Rehm et al., 2013). Moreover, alcohol use has a big economic impact for our society. The cost related to alcohol use in Spain, such as treatments, preventions, etc. is about 1-2% of GDP (OMS, 2010).

Its use is typically initiated and extended in adolescence, which is a key stage because the brain continues to develop (Marshall, 2014). Recent studies have suggested that adolescent development is characterized by a gap between changes in dopaminergic reward systems (producing increases in sensation seeking and reward seeking beginning at puberty) and the slower and more gradual development of top-down cognitive control, which is correlated with increased myelination both within the prefrontal cortex and between the cortical and subcortical areas (Chassin et al., 2013). Hence, this gap predisposes adolescents toward risk-taking behavior like alcohol consumption. So, developmental changes in these stressor-sensitive regions, which are critical for attributing incentive salience to drugs and other stimuli, are observed in this stage (Spear, 2000). Thus, adolescents may be particularly sensitive to the neurotoxic effects of alcohol, with associated neurocognitive damage that may be relatively durable. Therefore, heavy exposure to alcohol in teenagers has been associated with structural and functional brain deficit, as well as deficits in cognitive functioning (Chassin et al., 2013; Bava & Tapert, 2010).

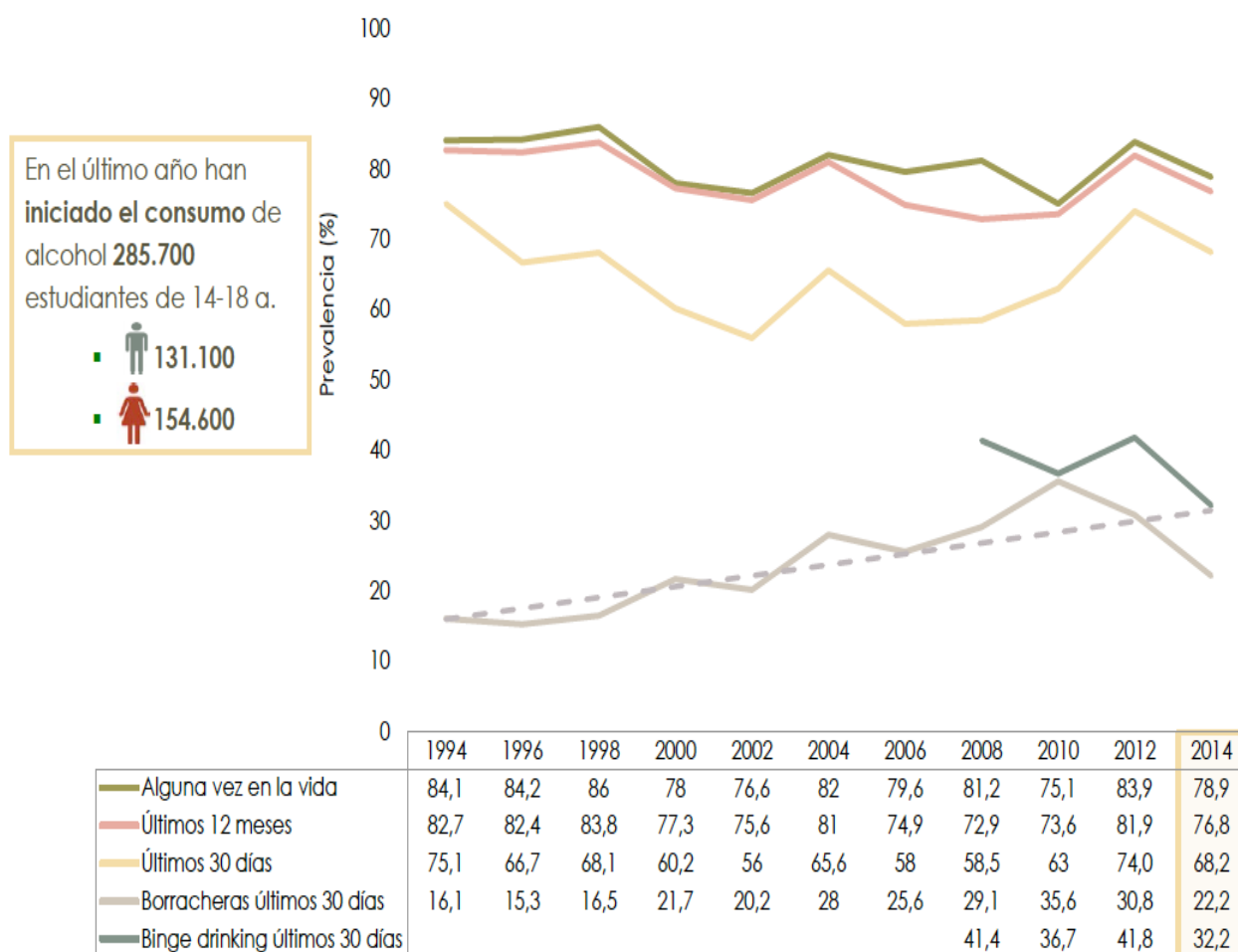
	Men	Women	Both
<b>Malignant neoplasms</b>			
Mouth and oropharynx cancers	22%	9%	19%
Oesophageal cancer	37%	15%	29%
Liver cancer	30%	13%	25%
Breast cancer	n/a	7%	7%
<b>Neuropsychiatric disorders</b>			
Unipolar depressive disorders	3%	1%	2%
Epilepsy	23%	12%	18%
Alcohol use disorders: alcohol dependence and harmful use	100%	100%	100%
Diabetes mellitus	-1%	-1%	-1%
<b>Cardiovascular disorders</b>			
Ischaemic heart disease	4%	-1%	2%
Haemorrhagic stroke	18%	1%	10%
Ischaemic stroke	3%	-6%	-1%
<b>Gastrointestinal diseases</b>			
Cirrhosis of the liver	39%	18%	32%
<b>Unintentional injury</b>			
Motor vehicle accidents	25%	8%	20%
Drownings	12%	6%	10%
Falls	9%	3%	7%
Poisonings	23%	9%	18%
<b>Intentional injury</b>			
Self-inflicted injuries	15%	5%	11%
Homicide	26%	16%	24%

Sources: references 7 and 8.

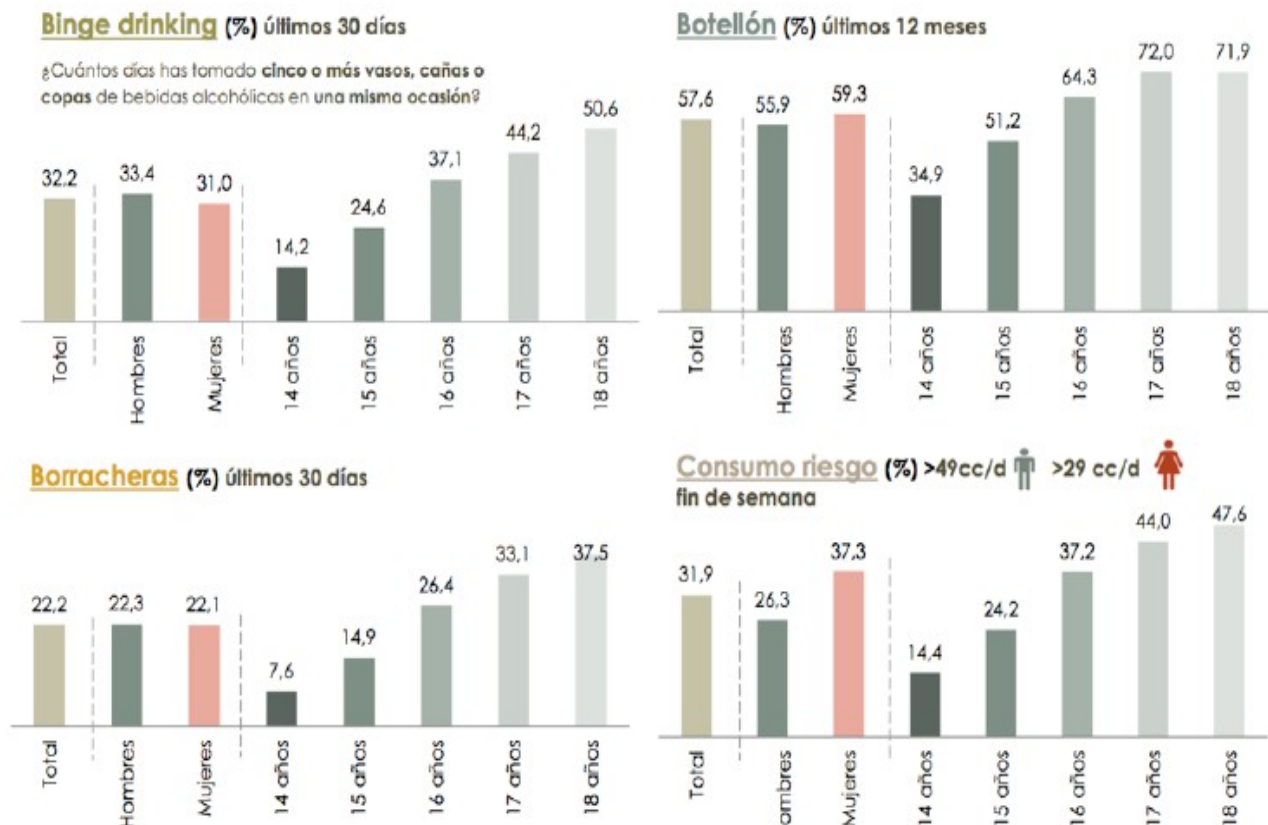
**Table 1: Major disease and injury conditions related to alcohol and proportions attributable to alcohol worldwide**

*Extracted from Room, Babor & Rehm, 2005*

The mean age of drinking initiation in Spain is 13.6 years, whereas 81,4% between 14-18 year olds have drunk over the last year (ESTUDES, 2013). Adolescent drinking should be a special matter of concern because it is the main risk factor that contributes to DALYS worldwide (Gore et al., 2011). Thus, alcohol abuse is the first and sixth cause of DALYS in young males and women respectively (Catalá-López, Gènova-Maleras, Álvarez-Martín, Fenández de Larrea-Baz & Morant-Ginestar, 2013). Alcohol use is associated with alcoholism and other negative outcomes in adulthood, such as health problems, alcohol-related disorders or other addictions (McCambridge et al., 2011). In addition, early alcohol use in adolescents is often related to other high-risk behaviours, such as antisocial behaviour, use of other drugs, poor school performance and violence, as well as engaging in unprotected sex and drunk driving. All these behaviors are associated with personality disinhibited characteristic (Ibáñez et al, 2008).



**Figure 1.** Percentages of consumption in Spanish adolescents (ESTUDES 2014/2015).

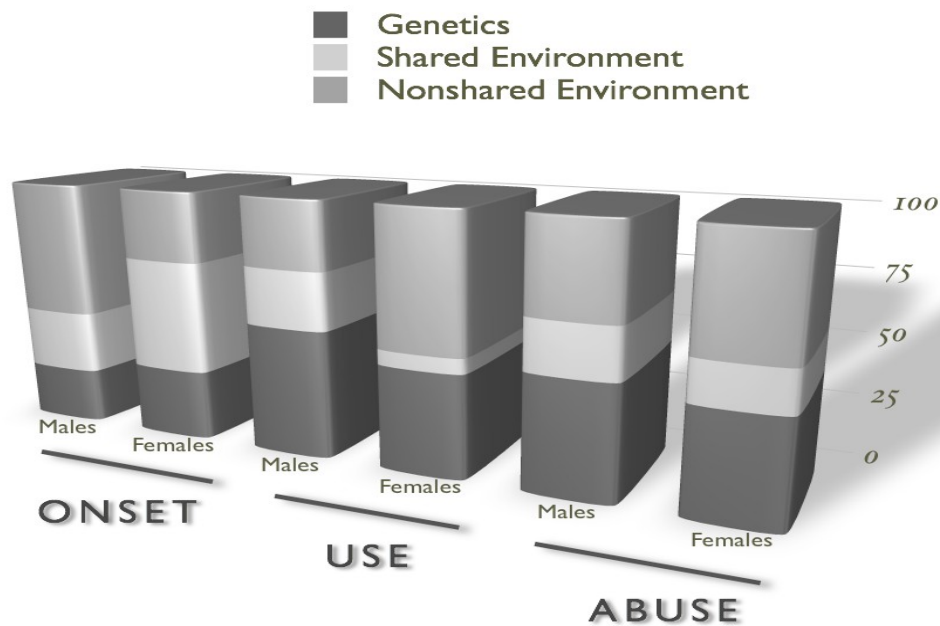


**Figure 2.** Patterns of alcohol use and misuse per age ( ESTUDES, 2014/2015).

However, individuals presents a wide variation in its patterns of alcohol use and misuse (see Figure 1 and 2). For example, approximately 10% of adolescents never have tasted alcohol, whereas 68% of adolescents has drunk alcohol during the last month, and more than 30% presented a binge drinking pattern during last month in Spain (ESTUDES, 2014/2015). Binge drinking, is defined by consuming five or more drinks (male), or four or more drinks (female) in about 2 hour, which brings blood alcohol concentration (BAC) levels to 0.08 g/dL or above (NIAA, 2004).

Which is the nature of these individual differences? Quantitative genetics studies allow to determine the nature of variability of a certain trait or behaviour (environmental or genetics) and so, to what extent each of these factors can explain individual differences in the alcohol use and abuse (Plomin, DeFries, Knopik, & Neiderhiser, 2013). The importance of genetic and environmental influences may be different in distinct stages or patterns of alcohol consumption, see Figure 3 (Pagan et al., 2006; Plomin et al., 2013) Thus, it has been shown that first contacts with alcohol are essentially due to shared environment. However, when age increases and alcohol use is habitual, genetic and nonshared environment become important. Therefore, in the adulthood genetic factors and nonshared environment almost affect the same, while shared environment is reduced, both in habitual consumption and in its pathological use (Fowler et al, 2007; Kendler, Schmitt, Aggen & Prescott, 2008). Interestingly, although pathological misuse are influenced by specific genes different from those influencing non-pathological alcohol use, it has been stimated that nearly 40% of genetic factors underlying alcohol use and misuse are the shared (Kendler et al, 2008).

Thus, a comprehensive approach that would aim to explain the individual differnces in alcohol use and misuse in a systematic way would requieres a biopsychosocial perspective, in wich a complex interplay of biological, psychological and social factors would explain behaviors related to alcohol consumption (Ibáñez et al., 2008).

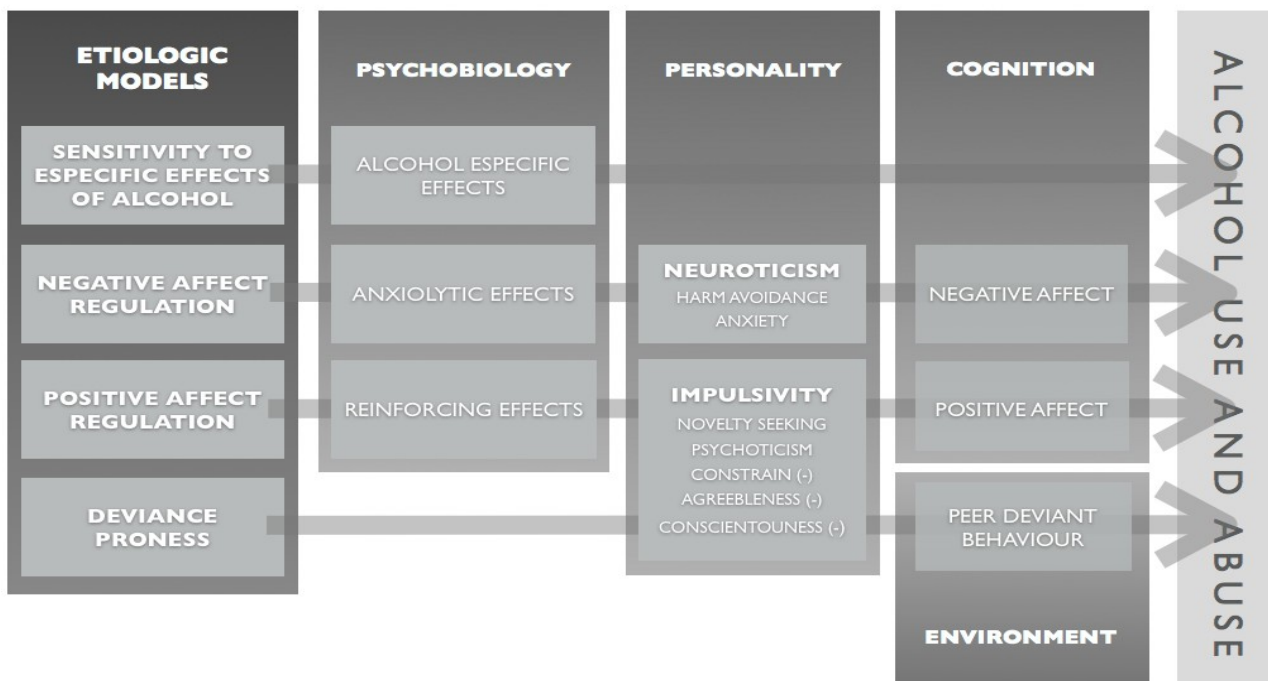


**Figure 3.** Genetic and environmental influences in distinct stages or patterns of alcohol consumption Adapted from Mezquita, Ibáñez & Ortet (2011).

Accordingly, different theoretical pathways have been suggested for the etiology of alcohol use and abuse (Sher et al., 2005). These pathways include specific biological, psychological and environmental factors that interact in explaining different patterns of alcohol outcomes. Specifically, four main pathways have been proposed: - Pharmacological vulnerability pathway, which proposes that different responses specific to the effects of alcohol are etiologically important; - positive affect regulation pathway, that refers to people who drink alcohol to get positive experiences; - negative affect regulation pathway, that is referred to reduce negative affects like anxiety; and finally, a deviance proneness pathway, associated with anti-normative behavior.

We will focus in three related and non mutually exclusive etiological pathways in which personality would play a relevant role, see Figure 4 (Ibáñez et al, 2008):

**Deviance proneness.** Alcohol use is part of a more general deviant pattern that has its roots in childhood and is attributable to deficient socialization (Sher et al, 2005). This pathway has long been recognized and has been associated with an early onset of alcohol use disorders (Chassin et al., 2013). It is demonstrated that children who are behaviorally disinhibited are at risk for school failure and for ejection from mainstream peer groups (Véronneau, Vitaro, Brendgen, Dishion, & Tremblay, 2010) which leaves them exposed to similarly undercontrolled peers (Sijtsema, Lindenberg, & Veenstra (2010) who provide opportunities and norms that encourage substance use behavior (Haller, Handley, Chassin, & Bountress, 2010). Ibáñez and colleagues (2008) indicate that impulsive traits facilitate in individuals an affiliation with peers with a high alcohol and other drug consumption and it would increase the probability of their own alcohol (and other drug) use. Thus, a direct effect between extraversion and alcohol consumption and a partial mediation effect of the same variables have been shown through affiliation with deviant peers, while agreeableness negatively showed a total mediation effect with alcohol consumption in young people through affiliation with deviant peers (Gallego-Moya, Camacho, Mezquita, Viruela, Ibáñez, Villa & Ortet; 2015). Deviance proneness pathway has been associated with alcohol-related problems, drinking at the weekend and drinking during the week through antisocial behavior (Mezquita et al., 2014).



**Figure 4.** Etiological pathways of alcohol consumption studied (Ibáñez et al, 2008).

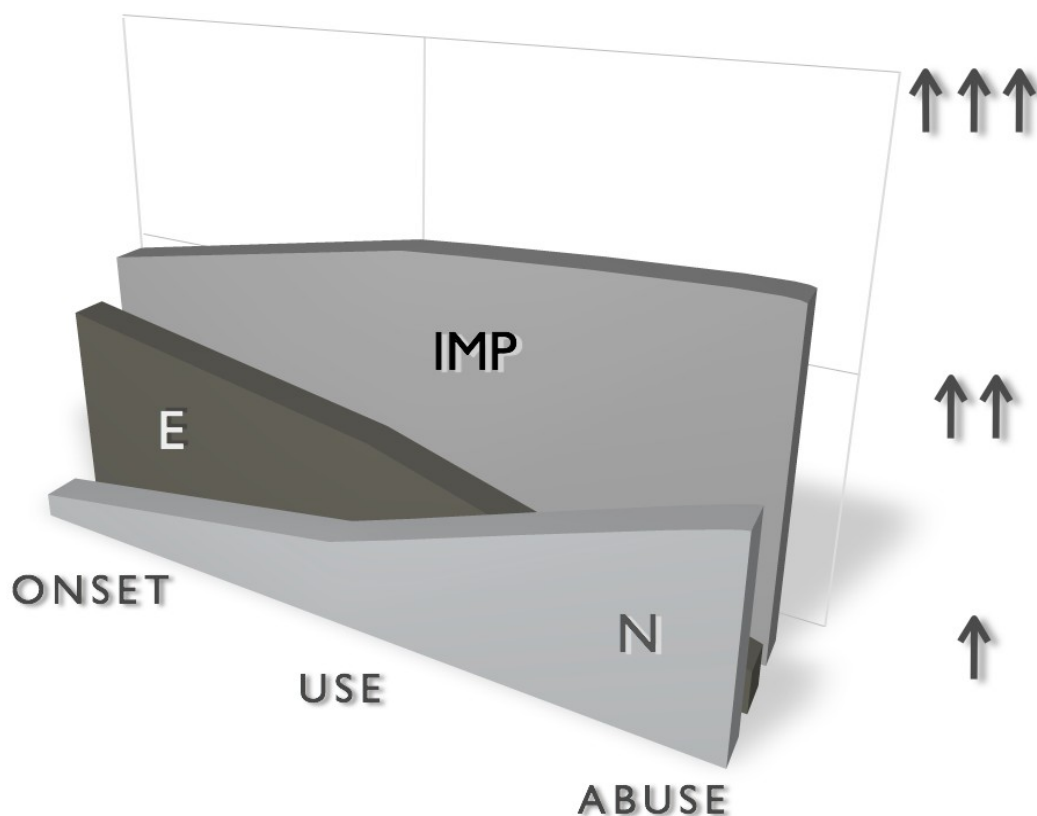
Negative affect regulation. One of the most enduring etiological perspectives on alcoholism is that alcohol use disorders develop because alcohol relieves negative affect (Sher et al., 2005). As Chassin et al. (2013) indicates “although much of the focus on stress-drinking relations concern adolescent and adult samples, exposure to stress and trauma early in development have also been shown to have long-term impact on alcohol involvement”. In this way, Fromme et al. (1993) showed many individuals hold strong expectations that alcohol is anxiety or stress reducing. In addition, many people report that they drink to cope with negative affect (e.g., “to forget your worries”) (Cooper et al. 1992). These coping motivations are strongly related to both alcohol consumption and problems (Sher, 1987). Therefore, the anxiolytic properties of alcohol are important motivational factors in alcohol consumption (Kuntsche et al, 2005), and anxiety-related traits modulate this motivation (Cooper et al., 2000). Empirical support for negative affect as the mediator of the association between stress and alcohol use is more consistent in adults than in adolescents (Chasin et al., 2013). As indicates “this pathway would be important once patterns of alcohol use are well established”. Mezquita and colleagues (2014) showed that negative affect regulation pathway was related to more problematic alcohol use in a longitudinal study where negative emotionality and coping motives would play a relevant role.

Positive affect regulation. Most drinker expect a positive experience that directly produces pleasurable experiences by alcohol consumption (Goldman et al. 1999). They seek positive reinforcement effects. Consequently, motivation to ‘enhance’ (e.g. drinking ‘to feel good’) is an important factor in alcohol use and abuse (Kuntsche et al., 2005). These positive expectancies and enhancing motivations are influenced by impulsive-related traits, specially “reward seeking” (Ibáñez et al., 2008) and appears to mediate on drinking outcome (Sher et al.,2005). Motivations for positive reinforcement from alcohol are based on alcohol’s neuropharmacological effects on the brain centers involved in basic reward mechanisms, such as mesolimbic dopamine or opioid systems (Sher, 2005). This pathway was associated with more recreational alcohol use in which positive emotionality and unconscientious disinhibition predicted alcohol use at weekends through enhancement and drinking motives, which were also associated with alcohol-related problems through their relation to drinking at the weekend (Mezquita et al., 2014).



As we have seen, personality characteristics are crucial in all these pathways. Indeed, personality is one of the most studied psychological factors in alcohol use and misuse (Sher et al., 2005). Ibáñez and colleagues (2008) grouped personality traits into three broad clusters in order to describe several lines of evidence that support the relationship between personality and alcohol use and abuse (Figure 5):

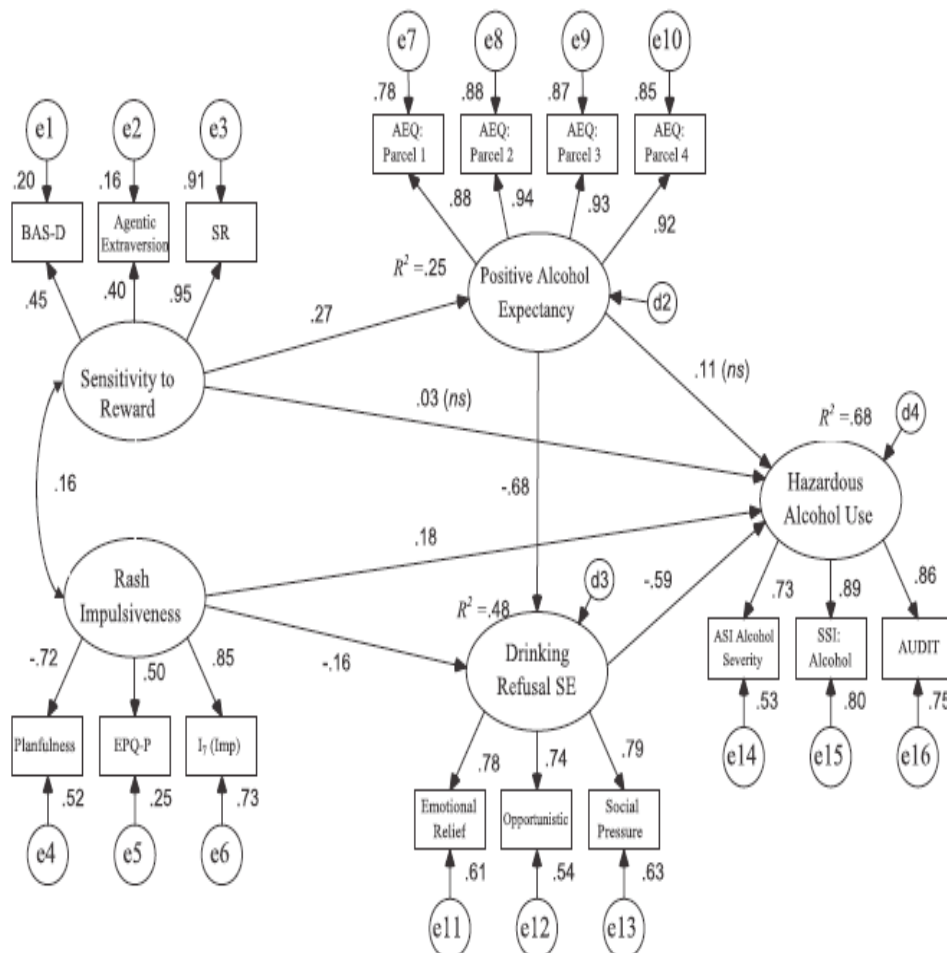
- Neuroticism/negative emotionality: which includes anxiety, harm avoidance, negative emotionality and neuroticism. Much research suggests a relationship between neuroticism/negative emotionality and clinical alcoholism. Individual with alcohol use disorders diagnoses tend to score higher on self-report measures of neuroticism and negative emotionality than do nonalcoholic controls (Sher et al., 2005).
- Extraversion/sociability: including sociability, activity, positive emotionality and extraversion. A relationship has been found between extraversion/sociability and drinking onset (Hill et al. 2000, Hill & Yuan 1999) as well as between extraversion and alcohol consumption among nonalcoholics (Sher et al., 2005).
- Impulsivity/disinhibition: including sensation seeking, aggressivity, novelty seeking, low constraint (impulsiveness), psychoticism, low agreeableness and low conscientiousness. Impulsivity and disinhibition have consistently been associated with use, abuse and the development of clinical alcoholism (Sher et al. 2005; Ibáñez, 2008).



**Figure 5.** Differential influence of the three broad clusters of personality traits in order to the stages of alcohol (extracted from Ibáñez et al, 2008).

Studies in adolescents and young adults have described that the impulsivity/disinhibition cluster is the most prominent in alcohol use development. It has been related to the onset and use of alcohol and other drugs, especially legal drugs, in different sociocultural contexts (Cooper, Agocha, & Sheldon, 2000). Extraversion/sociability cluster has been more related to alcohol use during adolescence, while neuroticism/negative emotionality cluster has been inconsistently related to alcohol use during this stage (Ibáñez et al., 2005).

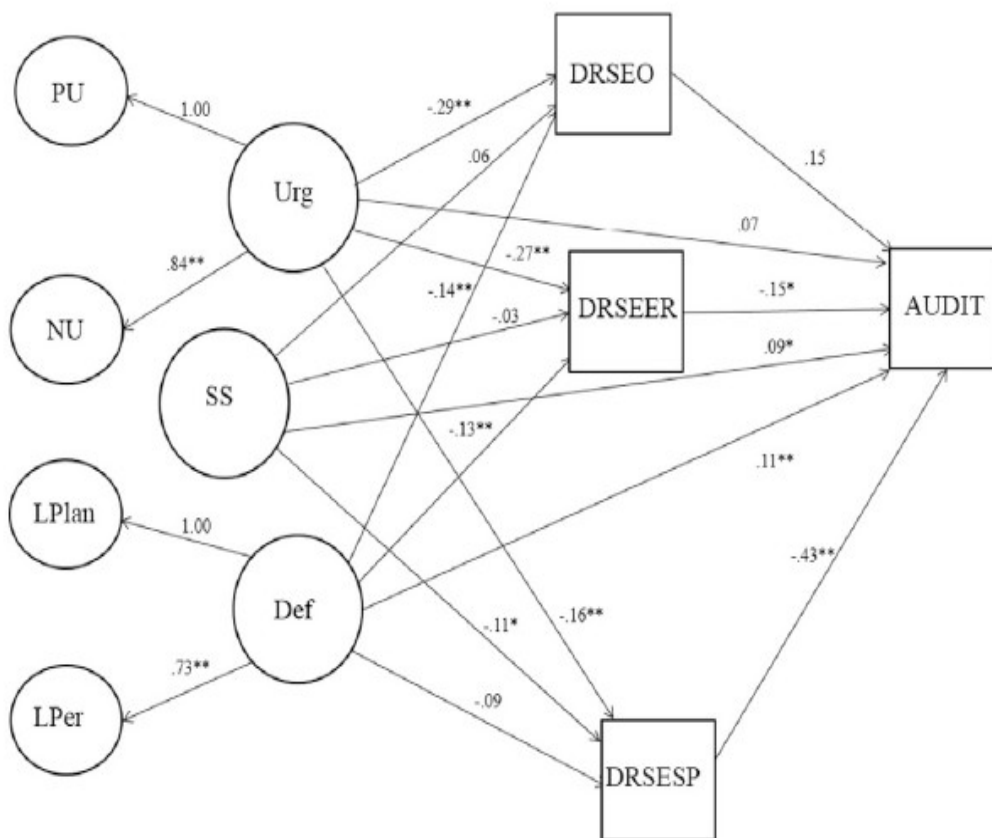
As we have mentioned, one of the most prominent personality constructs underlying alcohol use and misuse is impulsivity/disinhibition. However, impulsivity is not a simple one-dimensional trait, but also a complex multifaceted construct that would be associated to different personality domains (Evdenden, 1999; Whiteside & Lyman, 2001; Dawe and Loxton, 2004). Recently, it has been proposed two separate facets of impulsivity specially relevant to addictive behavior (Dawe and Loxton, 2004; de Wit and Richards, 2004; Gullo, M. J., Dawe, S., Kambouropoulos, N., Staiger, P. K. & Jackson, C. J.; 2010). The first component is sensitivity to reward (Dawe and Loxton, 2004), and this component would be reflected in traits such as extraversion or positive emotionality (Dawe and Loxton, 2004). The second component, rash impulsiveness, manifests as individual differences in inhibitory control and the propensity to act without forethought (Dawe and Loxton, 2004). This dimension would be probably more associated with low conscientiousness (Depue and Collins, 1999; Gullo and Dawe, 2008; Ibáñez et al., 2015).



**Figure 6.** Two distinct but related pathways underlying different aspects of impulsivity: sensitivity to reward (or positive affect regulation) pathway, and a rash impulsiveness (or force of will) pathway (extracted of Gullo et al., 2010).

Gullo and colleagues (2010) were the first to show that rash impulsiveness contributes to hazardous drinking through drinking refusal self-efficacy in patients and students (see Figure 6). Drinking refusal self-efficacy (DRSE) is a cognitive mechanisms (a person's ability to resist alcohol use) that contributes unique variance in the prediction of alcohol use over-and-above expectancies. The direct positive association between rash impulsiveness and alcohol misuse was partially mediated by lower drinking refusal self-efficacy in students, and fully in patients (Gullo et al, 2010). In consequence, rash individuals would expect to experience more difficulty refusing alcohol, perhaps due to awareness of their general difficulty in inhibitory control.

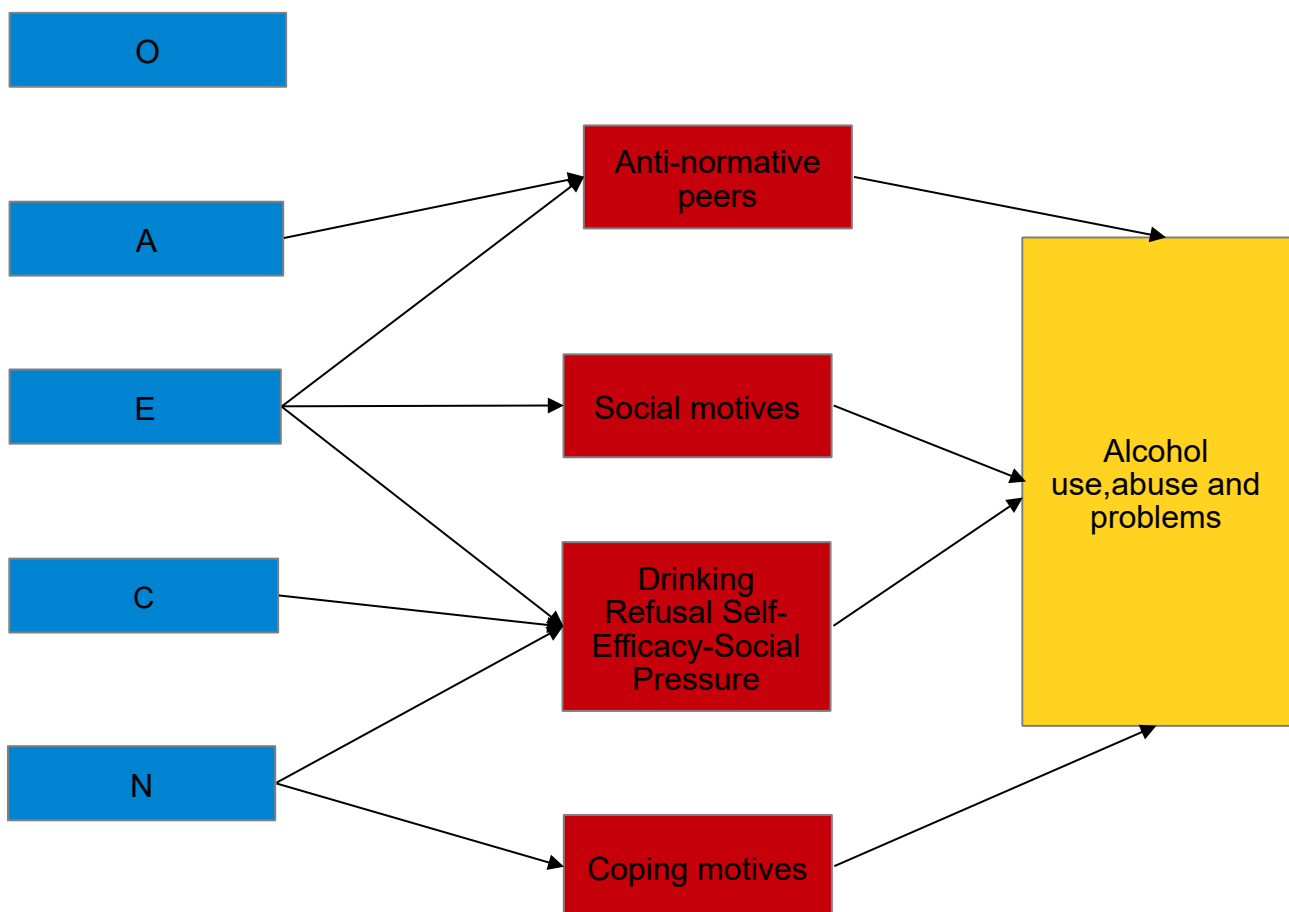
Recently, Stevens et al. (2016) has demonstrated that the social pressure subscale of DRSE, the ability to refuse alcohol in social situations, was a significant mediator of the respective relations between urgency, sensation seeking and, to a lower extent, deficits in conscientiousness, with alcohol problems (see Figure 7). Interestingly, urgency would be associated to Neuroticism, whereas sensation seeking would be related to extraversion (Whiteside and Lynam, 2001). Thereby, drinking refusal self-efficacy is a more proximal factor influencing problematic alcohol consumption that mediates the more distal influences of constructs related to impulsivity, as high Extraversion, high Neuroticism and low Conscientiousness. In reference to the above-mentioned etiological pathways, the “rash impulsiveness – DRSE – Alcohol” would constitute a distinct, although related, path.



**Figure 7.** Facets of impulsivity related to problematic alcohol involvement. Indicators of each facet of impulsivity were composed of three item parcels. PU = positive urgency. NU = negative urgency. Lplan = lack of planning. Lper = lack of perseverance. SS = sensation seeking. Urg = urgency. Def = deficits in conscientiousness. DRSESP = drinking refusal self-efficacy-social pressure. DRSEO = drinking refusal self-efficacy-opportunistic. DRSEER = drinking refusal self-efficacy-emotional relief. AUDIT = AUDIT score. Extracted from Stevens et al, 2016.

The aim of our study was to describe different etiological pathways to alcohol use in adolescents by means cross-sectional study (see Figure 8). We explored the importance and specific role of personality, motives, anti-normative behavior and drinking refusal self-efficacy in each etiological pathway. Based on previous research studies (Sher et al., 2005; Mezquita et al., 2014, Gullo et al, 2010, Stevens et al., 2016), we hypothesized:

1. Neuroticism will be related to alcohol-related problems through coping motives (negative affect regulation pathway).
2. Extraversion will be related to alcohol use at the weekend through social motives (positive affect regulation pathway).
3. Agreeableness (negatively) and extraversion will be related to alcohol use outcomes and alcohol-related problems through friends' antisocial behavior (deviance proneness pathway).
4. A new etiological pathway in alcohol use based on the key role of drinking refusal self-efficacy will be observed. Low conscientiousness, high neuroticism and high extraversion would be associated to rash impulsiveness and disinhibition, and will drive to less alcohol use and alcohol-related problems through favouring a greater drinking refusal self-efficacy in front of social pressure (force of will pathway).



**Figure 8.** Design of our hypothetical model. O, Openness; N, Neuroticism; E, Extraversion; A, Agreeableness; C, Conscientiousness.

## Materials and methods

### Participants

The sample consisted of 201 high school students from IES El Caminàs (distribution per level of education in Figure 9), 106 (52,7%) males and 95 (47.3%) females. Their mean age was 15,41 (SD = 1,124). Informed consent was obtained from each participant and the study was approved by the relevant university ethics committee.

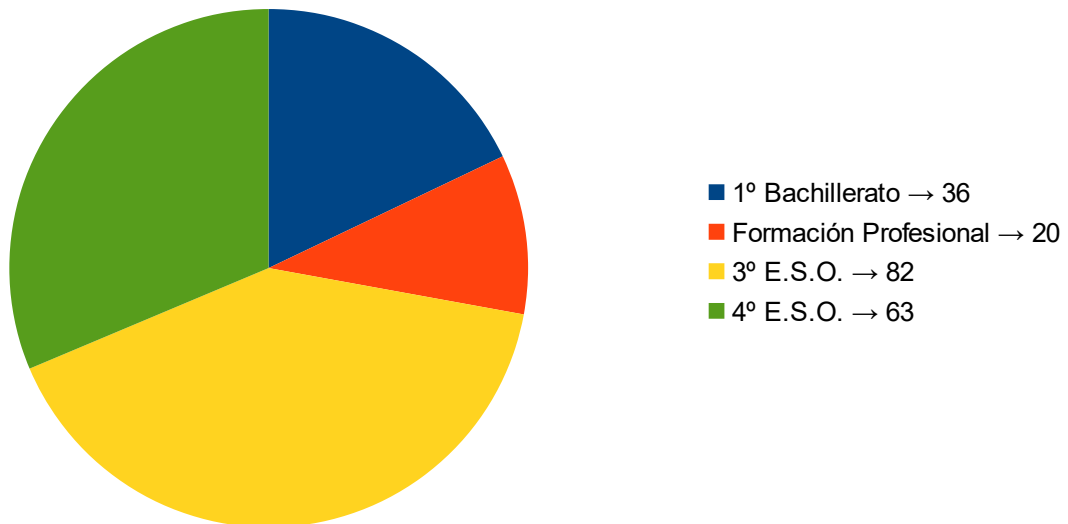


Figure 9. Sample's distribution per level of education.

### Measures

Participants completed demographic data including age and gender.

The JS NEO-S (Ortet et al., 2010) is a short form of the Junior Spanish version, between 12 and 18 years, of the NEO-PI-R (Costa & McCrae, 1992). This 150-item questionnaire assesses the five broad domains (Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness) and thirty more specific facets of the Five-Factor Model. Items are responded to on 5-point Likert scales ranging from 0 (strongly disagree) to 4 (strongly agree).

The Drinking Motive Questionnaire-Revised (DMQ-R; Cooper, 1994) was adapted to a short form in a sample of Spanish adolescents (M DMQ-R) by Mezquita et al. (2016). It consists of 12 items, and each contributes to one of four subscales: social, coping, enhancement, and conformity motives. After taking into account all the occasions on which they had drunk, the participants indicated how often they drink for each reason specified in each item on a 5-point scale (1 = almost never or never and 5 = almost always or always).

The Deviant Peer Scale (DPS) assesses anti-normative behaviors of friends in adolescents. This questionnaire was adapted to Spanish adolescents (Gallego, Viruela, Camacho, Mezquita & González, 2011). A short form of the scale was used of 16 items, each of them respond to on 5-point Likert scales ranging from 1 (none) to 5 (all). Participants must indicate the number of friends who have made the considered behaviors during last 6 months. Two factor were extracted, grave anti-normative behaviors and mild anti-normative behaviors.

The Drinking Refusal Self-Efficacy Questionnaire-Revised Adolescent Version (DRSEQ-RA) is designed to assess an individual's belief in their ability to resist drinking alcohol (Young, Hasking, Oei & Loveday, 2007). It is a 19-item measure designed to assess an individual's belief in their ability to resist alcohol under social pressure, for emotional relief or when presented with the opportunity. Responses are rated on a 6-point Likert scale, with higher scores indicating a higher level of refusal self-efficacy.

The Alcohol Use Disorders Identification Test (AUDIT; Babor, Higgins-Biddle, Saunders & Monteiro, 2001) includes 10 items on a 3- and 5-point Likert scale, which are grouped into three "alcohol consumption," "alcohol dependence" and "harmful alcohol use" subscales.

The Alcohol Intake Scale (AIS; Grau and Ortet, 1999) was used to assess drinking quantity. Participants responded with openended questions: how many drinks (beers, glasses of wine, liquors, and spirits) did they consume on weekdays (Monday to Thursday) and at weekends (Friday to Sunday). Then the number of Standard Drink Units (SDU) drunk were calculated after taking into account that beers and glasses of wine are the equivalent to 1 SDU, while liquors and spirits are the equivalent to 2 SDU. In Spain, an SDU is the equivalent to 10 g of alcohol.

## **Data Analysis**

First, descriptives, t-tests, Cronbach's alphas and correlations were calculated with the SPSS statistic package, version 21. In order to explore the direct and indirect relationships of personality, motives (cope and social), anti-normative behavior of friends and drinking refusal self-efficacy-social pressure to alcohol use and alcohol problems, we performed path analyses with the EQS software, version 6.1 (Bentler and Wu, 1995). Robust methods were used given the non-normality in the data. The model's goodness-of-fit was evaluated using the following fit indices: Satorra-Bentler chi-squared ( $S-B\chi^2$ ), normed chi-squared ( $S-B\chi^2/d.f.$ ), the comparative fit index (CFI), the incremental fit index (IFI), the non-normal fit index (NNFI), and the root mean square error of approximation (RMSEA). For a model to show a good fit,  $S-B\chi^2$  had to be non-significant, the normed  $S-B\chi^2$  had to be between 1 and 2, CFI, IFI, and NNFI had to be .95 or higher, and RMSEA had to be 0.05 or lower (Byrne, 2006).

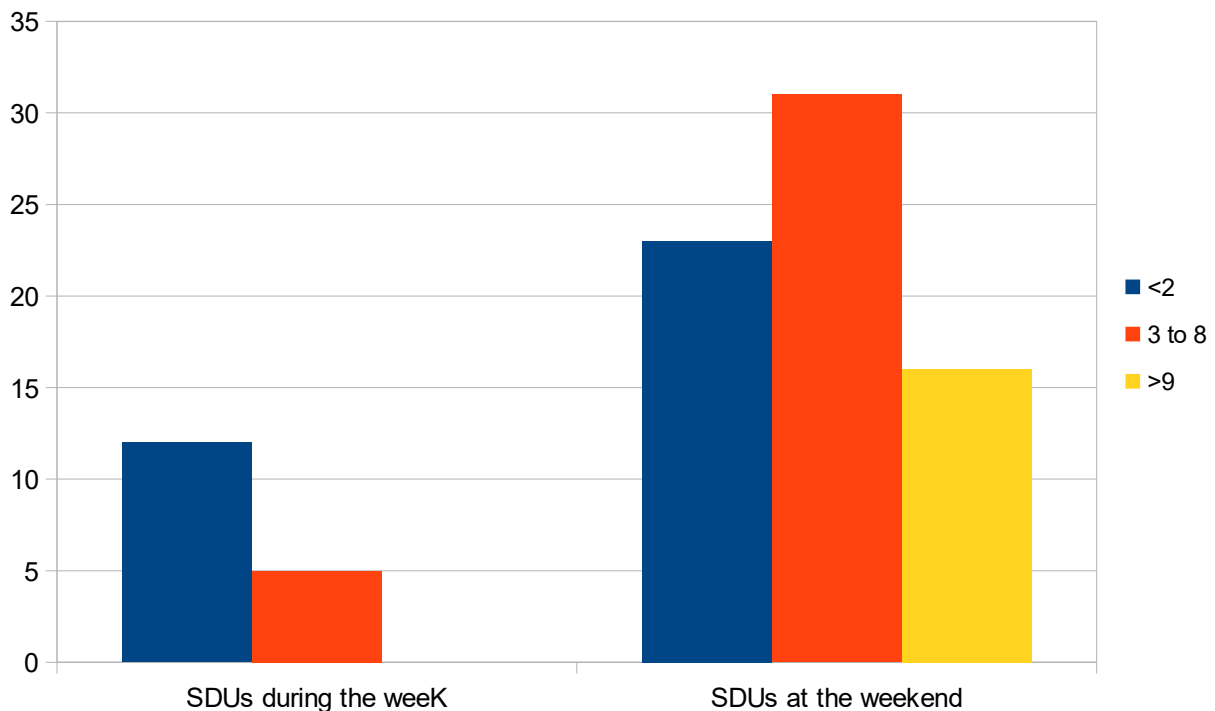
## **Results**

35,3% of the sample informed that they drunk alcohol (71 drinkers), with a mean of 8.3 SDUs (SD = 11.32). While, the remaining 64.7% (130) was non-drinkers. Furthermore, the descriptive analyses showed that alcohol consumption was concentrated at the weekend (see Figure 10). Additionally, the percentage of drinkers was higher among girls than among boys (36,8% vs. 34%, respectively). Women reported more neuroticism and openness to experience than men. On the other hand, men showed more drinking refusal self-efficacy-social pressure than women (see Table 2).

We tested the hypothesized model on the total sample. After adding the specifications suggested by the LM and Walt tests, the fit indices were good, ( $S-B\chi^2 = 33.65$ ,  $df = 32$ ,  $p = 0,39$ ;  $S-B\chi^2/df = 1.05$ ; CFI = 0.994; IFI = 0.995, MFI = 0.996; RMSEA = 0.016). As we hypothesized, personality was significantly related to alcohol outcomes through motives (social and coping), antisocial behavior of peers and drinking refusal self-efficacy-social pressure. Moreover, antisocial behavior and, especially, drinking refusal self-efficacy-social pressure were also linked to alcohol outcomes through the mediation of motives (see Figure 11). In particular, the next indirect effects were found: neuroticism was related to coping motives through drinking refusal self-efficacy-social pressure ( $\beta = 0.66$ ;  $p < 0,05$ ), extraversion was associated with social motives through anti-normative behavior ( $\beta = 0.204$ ;  $p < 0.001$ ), agreeableness was negatively related to drinking during the week ( $\beta = -0.036$ ;  $p > 0.5$ ), anti-normative behavior was linked to drinking at the weekend through social

motives ( $\beta = 0.077$ ;  $p < 0.5$ ), finally; anti-normative behavior, drinking refusal self-efficacy-social pressure (negatively) and social motives were related to alcohol-related problems through consumption ( $\beta = 0.235$ ,  $p < 0.01$ ;  $\beta = -0.210$ ,  $p < 0.001$ ;  $\beta = 0.093$ ,  $p < 0.01$ ; respectively). Additionally, we observed the following direct effects: agreeableness (negatively) and extraversion were associated with anti-normative behavior ( $\beta = -0.317$ ,  $p < 0.001$ ;  $\beta = 0.222$ ,  $p < 0.05$ ); neuroticism, extraversion (both negatively) and conscientiousness were linked to drinking refusal self-efficacy-social pressure ( $\beta = -0.157$ ,  $p < 0.05$ ;  $\beta = -0.36$ ,  $p < 0.001$ ;  $\beta = 0.214$ ,  $p < 0.01$ ); anti-normative behavior, drinking refusal self-efficacy-social pressure (negatively) and neuroticism were associated with coping motives ( $\beta = 0.193$ ,  $p < 0.05$ ;  $\beta = -0.423$ ,  $p < 0.001$ ;  $\beta = 0.168$ ,  $p > 0.05$ ); anti-normative behavior, drinking refusal self-efficacy-social pressure (negatively) and extraversion were linked to social motives ( $\beta = 0.241$ ,  $p < 0.01$ ;  $\beta = -0.419$ ,  $p < 0.001$ ;  $\beta = 0.36$ ,  $p < 0.05$ ); drinking refusal self-efficacy-social pressure, agreeableness (both negatively) and anti-normative behavior were related to drinking during the week ( $\beta = -0.130$ ,  $p > 0.05$ ;  $\beta = -0.193$ ,  $p > 0.05$ ;  $\beta = 0.114$ ,  $p > 0.05$ ); anti-normative behavior and social motives were linked to drinking at the weekend ( $\beta = 0.489$ ,  $p < 0.01$ ;  $\beta = 0.322$ ,  $p < 0.001$ ); finally, anti-normative behavior, drinking refusal self-efficacy-social pressure (negatively), coping motives, social motives, drinking during the week and drinking at the weekend were related to alcohol problems ( $\beta = 0.371$ ,  $p < 0.05$ ;  $\beta = -0.450$ ,  $p < 0.001$ ;  $\beta = 0.187$ ,  $p < 0.001$ ;  $\beta = 0.276$ ,  $p < 0.05$ ;  $\beta = 0.121$ ,  $p < 0.01$ ;  $\beta = 0.289$ ,  $p < 0.001$ ). The indirect and total effects are presented in Table 3.

### Distribution of alcohol consumption



**Figure 10.** Drinking quantity during the week (Monday to Thursday) and at weekends (Friday to Sunday) in drinkers. Standard Drink Units (SDU): beers and glasses of wine are the equivalent to 1 SDU, while liquors and spirits are the equivalent to 2 SDU.

**Table 2.** Means, SD and minimum and maximum score for the Assessed Variables, p-Values, and Cohen's d Associated with Gender. Cohen's d values of 0.20, 0.50, and 0.80 correspond to small, medium, and large effect sizes, respectively (Cohen, 1992). JS NEO- S: Junior Spanish version of the NEO-PI-R, DRSEQ-RA: Drinking Refusal Self-Efficacy Questionnaire-Revised Adolescent Version, M-DMQ-R: Drinking Motive Questionnaire-Revised adapted to Spanish adolescents, DPS: Deviant Peer Scale, AUDIT: Alcohol Use Disorders Identification Test.

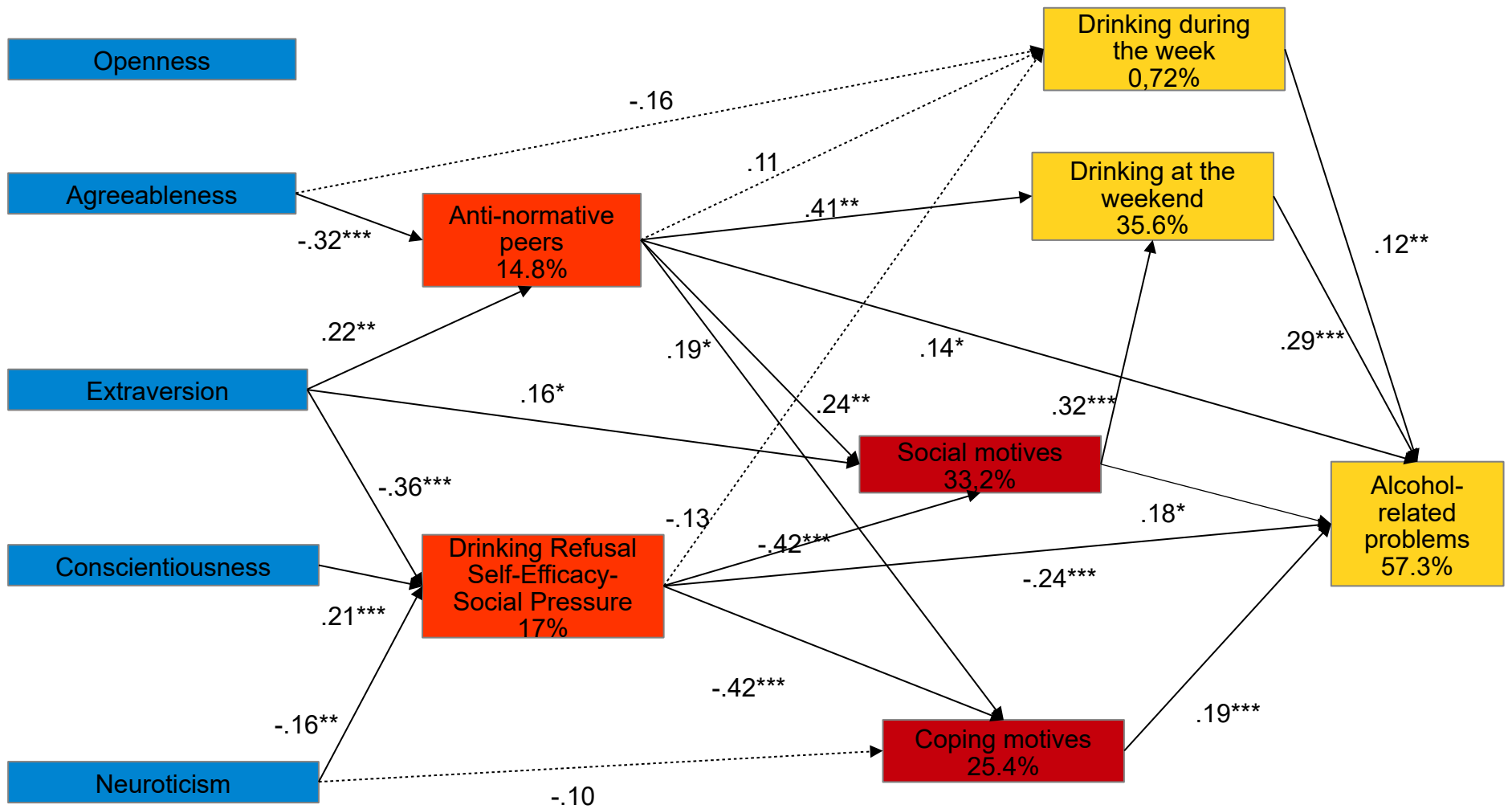
	<b>Total sample Mean (SD) (n=201)</b>	<b>Men Mean (SD) (n=106)</b>	<b>Women Mean (SD) (n=95)</b>	<b>t-Test (p)</b>	<b>Cohen's (d)</b>	<b>MIN.</b>	<b>MAX.</b>
<b>JS NEO-S</b>							
<b>Neuroticism</b>	57.29 (15.52)	53.23 (14.75)	61.83 (15.16)	< 0.01	-0.57	18	111
<b>Extraversion</b>	73.08 (11.53)	71.86 (11.94)	74.44 (10.96)	ns	-0.17	36	100
<b>Openness</b>	58.70 (10.65)	55.44 (10.03)	62.34 (10.17)	< 0.01	-0.68	28	85
<b>Agreeableness</b>	67.81 (10.33)	67.18 (11.03)	68.52 (9.5)	ns	-0.1	34	89
<b>Conscientiousness</b>	71.03 (17.22)	69.12 (16.96)	73.16 (17.35)	ns	-0.23	29	114
<b>DRSEQ-RA</b>							
<b>DRSEQ-R: social pressure</b>	19.15 (7.16)	20.94 (5.85)	17.16 (7.95)	< 0.01	0.4	0	25
<b>M-DMQ-R</b>							
<b>Social</b>	2.55 (3.32)	2.24 (3.34)	2.91 (3.28)	ns	-0.33	0	12
<b>Coping</b>	0.85 (1.82)	0.65 (1.70)	1.06 (1.92)	ns	-0.22	0	9
<b>DPS</b>							
<b>Anti-normative behavior</b>	6.58 (7.66)	6.85 (8.06)	6.28 (7.23)	ns	0.07	0	42
<b>ALCOHOL USE</b>							
<b>SDU during the week</b>	0.24 (1.12)	0.25 (1.13)	0.23 (1.13)	ns	0.02	0	10
<b>SDU at the weekend</b>	2.69 (7.38)	3.03 (9.1)	2.32 (4.83)	ns	0.1	0	68
<b>AUDIT</b>							
<b>Alcohol-related problems</b>	2.45 (3.62)	2.12 ( 3.78)	2.81 ( 3.42)	ns	-0.19	0	24



**Table 3.** Indirect and total effects of the path analysis.

<b>Indirect effects</b>		
<b>Path</b>	<b>St. beta</b>	<b>p</b>
<b><i>Negative affect regulation</i></b>		
N → Coping motives	0.66	0.29
<b><i>Positive affect regulation</i></b>		
E → Social motives	0.204	0.00
Social motives → Alcohol-related problems	0.093	0.003
<b><i>Deviance proneness</i></b>		
A → Drinking during the week	-0.04	0.195
Anti-normative behavior of friends → Drinking at the weekend	0.077	0.029
Anti-normative behavior of friends → Alcohol-related problems	0.235	0.001
<b><i>Refusal self-efficacy – social pressure</i></b>		
DRSESP → Alcohol-related problems	-0.21	0.000
<b>Total effects</b>		
<b>Path</b>	<b>St. beta</b>	<b>p</b>
<b><i>Negative affect regulation</i></b>		
N → Coping motives	0.168	0.058
Coping motives → Alcohol-related problems	0.187	0.000
<b><i>Positive affect regulation</i></b>		
E → Social motives	0.360	0.013
Social motives → Drinking at the weekend	0.322	0.000
Social motives → Alcohol-related problems	0.276	0.01
<b><i>Deviance proneness</i></b>		
A → Anti-normative behavior of friends	-0.317	0.000
E → Anti-normative behavior of friends	0.222	0.010
Anti-normative behavior of friends → Drinking during the week	0.114	0.200
A → Drinking during the week	-0.193	0.100
Anti-normative behavior of friends → Drinking at the weekend	0.489	0.009
Anti-normative behavior of friends → Alcohol-related problems	0.371	0.048
<b><i>Refusal self-efficacy – social pressure</i></b>		
N → DRSESP	-0.157	0.016
E → DRSESP	-0.36	0.000
C → DRSESP	0.214	0.001
DRSESP → Drinking during the week	-0.130	0.194
DRSESP → Alcohol-related problems	-0.450	0.000
<b><i>Common paths shared</i></b>		
Anti-normative behavior of friends → Social motives	0.241	0.002
DRSESP → Social motives	-0.419	0.000
Anti-normative behavior of friends → Coping motives	0.193	0.034
DRSESP → Coping motives	-0.423	0.000
Drinking during the week → Alcohol-related problems	0.121	0.004
Drinking at the weekend → Alcohol-related problems	0.289	0.000

N, Neuroticism; E, Extraversion; A, Agreeableness; C, Conscientiousness; DRSESP, Drinking Refusal Self-Efficacy-Social Pressure.



**Fig. 11.** Standardized  $\beta$  coefficients are represented. On the lines we find the standardized solutions, which are significant at \* $p < 0.05$ , \*\* $p < 0.01$ , and \*\*\* $p < 0.001$ . On the discontinuous line, there are the non-significatives at  $p > 0.05$ . Boxes show the percentages of explained variance ( $R^2$ ). The correlations among personality dimensions and drinking frequency, and all error terms were omitted for simplicity. Blue, personality dimensions; orange, more proximal variables than personality; red, motives; yellow, alcohol outcomes.

## Discussion

The main aim of the present study was to identify the different etiological pathways involved in the development of alcohol use and alcohol-related problems in adolescents. We examined the role that personality, peers' antinormative behavior, social pressure-DRSE and drinking motives play in these pathways, testing the significant role of social pressure-DRSE as a protective pathway.

According to the Plan Nacional sobre Drogas, approximately 68% of students (between 14 and 18 years) have drunk in the last 30 days (ESTUDES 2014/2015). However, a smaller percentage of our sample informed that they drunk alcohol, 35,3%. We find that, probably, because our sample is too young (mean age = 15,41 and SD = 1,124). Alcohol consumption was concentrated at the weekend, in which are observed characteristic patterns of consumption in adolescence. For example, binge drinking or “borrachera” (ESTUDES 2014/2015).

A more reported neuroticism and conscientiousness in women was found. A similar results to those described in previous studies (Mezquita et al., 2014). In addition, women reported more openness than men.

Any significative relationship with drinking during the week was found, probably, we observed that because alcohol use in adolescence is unusual during the week.

Our results support the idea that different personality characteristics would lead to distinct alcohol use patterns through different etiological pathways (Ibáñez et al, 2015). Regarding these different etiological pathways involved in the development of alcohol use and misuse, our results showed the co-occurrence of the 3 main paths and a new preventive path characterized by social pressure-DRSE. The described pathways, except the resist alcohol under social pressure pathway, clearly resemble those proposed by Sher and colleagues (2005) for the development of alcohol use disorders: negative affect regulation, positive affect regulation, and deviance pronenes.

The *negative affect regulation pathway* was related to more problematic alcohol use, in which neuroticism and coping motives would play a key role, coping motives fully mediated the association between neuroticism and alcohol-related problems. In contrast to Mezquita and colleagues (2014), we did not find a significative association between neuroticism and coping motives, although it shows a tendency ( $p = 0.058$ ). Probably, this could be attributed to the low prevalence of problematic alcohol use at these ages. 83,2% of drinkers in our sample do not show alcohol-related problems according to the scoring of AUDIT (Babor, Higgins-Biddle, Saunders & Monteiro, 2001).

The *positive affect regulation pathway* was associated with more recreational alcohol use in which the personality characteristics of extraversion played a more prominent role through social motives. Specifically, extraversion was linked to alcohol use at the weekend through social drinking motives. Moreover, this pathway was also associated with alcohol-related problems, directly and through their relations to drinking at the weekend. Similar results have been found in adults but with enhancement motives. Probably, in adolescents, social motives are the most important positive motives in alcohol consumption due to the influence of peers grows in adolescence. The adolescent substance abuse literature has consistently shown that adolescents and young adults resemble their peers with respect to substance use (Sher et al., 2005). Andrews et al. (2002) explain this similarity through two processes: socialization and selection. Socialization occurs when an individual's alcohol use is shaped by influence from the peer group. In this case, substance-using peers may encourage greater involvement with alcohol through various mechanisms (e.g social learning or peer group influence). In the other

hand, selection occurs when adolescents seek affiliation with peers who display similar patterns of substance use (Mezquita et al, 2014).

The *deviance proneness pathway* was associated with all the alcohol-related outcomes (non significantly in drinking during the week) through anti-normative behavior of friends. Specifically, extraversion and low agreeableness was related to drinking at the weekend, alcohol-related problems and motives through anti-normative behavior of friends. We did not find any association between low conscientiousness and friends' anti-normative behavior, something usually finds in similar studies in adults (Mezquita et al., 2014) and adolescents (Gallego et al., 2015). The association between anti-normative behavior of friends and alcohol outcomes was partially mediated by motives. In particular, anti-normative behavior of friends was linked to drinking at the weekend through social motives; while, the relation between anti-normative behavior of friends and alcohol-related problems was mediated by coping motives. Our results highlight the idea that adolescents from dysfunctional, or disturbed environments, or those with a predisposition toward antisocial behavior, are most likely to become involved with deviant peer groups through the selection process (Fergusson et al. 1999). Consequently, the proportion of peer associates who use alcohol and engage in deviant behavior is a powerful predictor of the development of alcohol abuse and dependence in adolescence (Fergusson et al., 2002; Windle, 2000).

We show the role of social pressure subscale of DRSE in a new etiological pathway of alcohol use, we called it *force of will pathway*. This protective path was negatively associated with alcohol consumption and alcohol-related problems. Specifically, low extraversion, low neuroticism and conscientiousness was negatively linked to alcohol-related problems and motives through drinking refusal self-efficacy under social pressure. In this way, the relation between drinking refusal self-efficacy-social pressure and alcohol-related problems was partially mediated by coping motives. On the other hand, drinking refusal self-efficacy-social pressure was linked to drinking at the weekend through social motives. Our results continue on the line of the recent research. Stevens et al. (2016) showed that individuals relatively high in urgency (neuroticism) may be less likely to refuse alcohol in situations where mood might be elevated (e.g., during drinking events). They also observed that individuals higher in sensation seeking (associated with extraversion) are more often drawn to rewarding, novel situations, which are characteristic of social drinking environments. To sum up, drinking refusal self-efficacy-social pressure mediate the relation between the heterogeneous construct of impulsivity (characterized by extraversion, conscientiousness and neuroticism) and alcohol outcomes, through motives in some cases. Observing that, interventions would include behavioral rehearsal role-play of social situations involving drinking.

The present work has several limitations. Our design is cross-sectional, so it does not allow establishing causal relationships between variables. In addition, the model could be expanded to include other relevant mediators, for example alcohol expectancies, parental environment or social support, between others. In addition, and due to sample limitations, we have not examined the differential role of variables as a function of gender. Thus, a longitudinal research that would include a systematic selection of risk and protective factors and independently analyze in boys and girls should provide a more comprehensive understanding of the etiological mechanisms underlying different drinking patterns.

In summary, the results of the present research identify 4 co-occurring etiological pathways of alcohol consumption. The negative affect regulation pathway includes neuroticism, and coping motives, linked to alcohol-related problems. The positive affect regulation pathway implies extraversion which predict a more recreational use of alcohol at weekends through its relationship to social drinking motives. The deviance proneness pathway based on extraversion and low agreeableness which predict alcohol outcomes through anti-normative behavior of friends. Finally, the social drinking refusal pathway includes personality traits related to disinhibition and has an important preventive role in alcohol use. The present study highlights the relevance of personality domains, anti-normative behavior of friends, drinking refusal self-efficacy-social pressure and motives in adolescent alcohol use and abuse, illustrating the complex interplay of these factors. A better understanding of adolescent alcohol use may help improve prevention and treatment programs in earlier alcohol use in adolescence.

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