

# Psychotic-like Experiences and Substance Use in College Students

## *Experiencias psicóticas atenuadas y consumo de sustancias en universitarios*

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### Abstract

Psychotic disorders, as well as psychotic-like experiences and substance use, have been found to be associated. The main goal of the present study was to analyse the relationship between psychotic-like experiences and substance use in college students. The sample comprised a total of 660 participants (M = 20.3 years, SD = 2.6). The results showed that 96% of the sample reported some delusional experience, while 20.3% reported at least one positive psychotic-like experience. Some substance use was reported by 41.1% of the sample, differing in terms of gender. Substance users reported more psychotic-like experiences than non-users, especially in the positive dimension. Also, alcohol consumption predicted in most cases extreme scores on measures of delusional ideation and psychotic experiences. The association between these two variables showed a differentiated pattern, with a stronger relationship between substance use and cognitive-perceptual psychotic-like experiences. To some extent, these findings support the dimensional models of the psychosis phenotype and contribute a better understanding of the links between psychotic-like experiences and substance use in young adults. Future studies should further explore the role of different risk factors for psychotic disorders and include models of the gene-environment interaction.

*Keywords:* Substance use; Addiction; Psychosis; Schizotypy; Cannabis; Psychotic-like experiences.

### Resumen

Los trastornos del espectro esquizofrénico, así como las experiencias psicóticas, se han asociado con un mayor consumo de sustancias. El objetivo de este trabajo fue analizar la relación entre las experiencias psicóticas atenuadas y el consumo de sustancias en adultos jóvenes. La muestra la formaron un total de 660 participantes universitarios (M = 20,3 años; DT = 2,6). Los resultados mostraron que un 96% de la muestra informó de alguna experiencia de ideación delirante, mientras que el 20,3% informó de, al menos, una experiencia atenuada de tipo cognitivo-perceptual. El 41,1% de la muestra refirió algún consumo de sustancias, encontrándose diferencias en función del género. Los participantes consumidores informaron de un mayor número de experiencias psicóticas, sobre todo de tipo positivo. Asimismo, el consumo de alcohol predijo, en la mayoría de los casos, las puntuaciones extremas en las medidas de ideación delirante y experiencias pseudo-psicóticas. La asociación entre estas dos variables parece mostrar un patrón diferenciado, encontrándose el consumo de sustancias más relacionado con las experiencias pseudo-psicóticas de tipo cognitivo-perceptual. Estos hallazgos parecen apoyar los modelos dimensionales del fenotipo psicótico y permiten mejorar la comprensión de la relación entre las experiencias psicóticas atenuadas y el consumo de sustancias en adultos jóvenes. Futuros estudios deberían seguir analizando el papel de los factores de riesgo a los trastornos psicóticos, así como incorporar modelos de interacción gen x ambiente.

*Palabras clave:* Consumo de sustancias; Adicción; Psicosis; Esquizotipia; Cannabis; Experiencias psicóticas atenuadas.

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Substance use and abuse is common amongst patients with disorders along the psychotic spectrum (Buckley, Miller, Lehrer, & Castle, 2009). Substance use and abuse has been associated with poorer clinical evolution, earlier onset, longer duration of untreated psychosis, exacerbation of symptoms, higher number of relapses and hospitalizations and worse adherence to treatment, among other aspects (Broussard et al., 2013; González-Pinto et al., 2011; Henquet et al., 2010; Lambert et al., 2005; Stefanis et al., 2014; Wade et al., 2006; Wisdom, Manuel, & Drake, 2011; Zammit et al., 2008). Furthermore, previous use of certain substances, such as cannabis, for example, apparently increases the subsequent risk of developing psychosis, as well as rates of subclinical psychotic symptoms and psychotic-like experiences, in both the general population (Henquet, Murray, Linszen, & Van Os, 2005; Kuepper et al., 2011; McGrath et al., 2010; Moore et al., 2007) and in family members of patients with psychosis (McGuire et al., 1995). For example, epidemiological studies have found that the start of using cannabis in adolescence increases the probability of experimenting symptoms and disorders of the psychotic spectrum during adulthood (Arseneault et al., 2002) and promotes the persistence of psychotic-like experiences (Mackie et al., 2013). Similar results are found in longitudinal assessments of participants clinically classified as high risk (high risk mental conditions). Nevertheless, there is insufficient evidence to associate substance use with a higher probability of transitioning to psychosis (Addington et al., 2014).

The dimensional approach of the psychotic phenotype suggests that psychotic experiences (e.g., delusional ideation, fantastical beliefs) are distributed along a continuum of gravity, with psychotic symptoms positioned at the extreme (van Os, Linscott, Myin-Germeys, Delespaul, & Krabbendam, 2009). These psychotic experiences, though attenuated, are normally distributed among the general population, without necessarily being associated with distress, disability and need for treatment (Linscott & van Os, 2013; McGrath et al., 2015). This series of attenuated experiences, when persistent over time and accompanied by a sense of distress, concern and search for aid, are usually referred to as psychotic-like symptoms (Fonseca-Pedrero, Paino, & Fraguas, 2013; Yung et al., 2007). These types of attenuated experiences are considered a phenotypical marker of vulnerability for disorders of the psychotic spectrum, in general, and for schizophrenia, in particular (Debbané et al., 2015; Linscott & van Os, 2013). Therefore, it is possible that the identification of this series of subclinical experiences will allow the early detection and identification of participants who are vulnerable to a serious mental disorder, such as psychosis. Likewise, these types of psychotic-like experiences could be combined with other risk markers (proximal or distal), for example, substance use and abuse, trauma or growing up in an urban environment (van Os, Kenis, & Rutten, 2010), for the purpose of examining possible underlying aetiological

mechanisms and for improving early detection and prevention strategies and programmes. The possible effect of substance use among high risk individuals or those vulnerable to psychosis could be impacted by different factors, such as: age of first use, pattern and frequency of substance use or pre-existent vulnerability (Casadio, Fernandes, Murray, & Di Forti, 2011; Valmaggia et al., 2014).

Previous studies have associated attenuated psychotic experiences with substance use and abuse, especially cannabis (Barkus, Stirling, Hopkins, & Lewis, 2006; Mackie et al., 2013; Saha et al., 2011; Schubart et al., 2011; van Os et al., 2002). The results seem to indicate that this association is more probable and increases among those participants with a certain, latent predisposition, or who report a family history of psychosis (Henquet, Krabbendam, et al., 2005; Stowkowy & Addington, 2013; van Os et al., 2002). In a longitudinal study, van Os et al. (2002) found that the use of cannabis predicted the presence of psychotic symptoms three years later, as well as their degree of severity and need for treatment. In another epidemiological study carried out in Australia, Saha et al. (2011) found that delusional experiences were associated with a higher use of tobacco, cannabis and alcohol. These studies analysed the role of attenuated positive psychotic experiences (e.g., delusional ideation or hallucinations), though the effect of attenuated negative psychotic experiences (e.g., flat affect or inability to feel pleasure) are not analysed in depth (Schubart et al., 2011).

Convergent results have been found when the relationship between schizotypal traits and substance use is examined (Barkus et al., 2006; Davis, Compton, Wang, Levin, & Blanco, 2013; Fumero, Santamaría, & Navarrete, 2009; Najolia, Buckner, & Cohen, 2012; Nunn, Rizza, & Peters, 2001). Schizotypal traits are intimately related with psychotic-like experiences and sometimes the terms are used interchangeably (Kwapil & Barrantes-Vidal, 2015). Both constructs are normally distributed among the general population within a continuum of severity of psychosis. However, schizotypal traits bring together a larger series of attenuated psychotic symptoms (e.g., positive, negative and depressive dimensions) and greater stability (trait). On the other hand, psychotic-like experiences more frequently refer to positive symptoms that are temporary in nature (state). As occurs in studies on psychotic-like experiences, individuals with higher scores on measures of schizotypy that participate in longitudinal follow-ups have a greater likelihood of developing substance abuse disorders (Kwapil, 1996). Likewise, transversal studies have reported that schizotypal traits are predictors of alcohol and tobacco use among college students in Spain (Fumero et al., 2009). In this regard, several studies indicate that users of cannabis and/or alcohol obtain lower scores on the negative dimension of schizotypy in comparison with non-users (Nunn et al., 2001; Skosnik, Park, Dobbs, & Gardner, 2008), though other studies do not find this association (Barkus et al., 2006; Dumas et al., 2002;

Fridberg, Vollmer, O'Donnell, & Skosnik, 2011; Schiffman, Nakamura, Earleywine, & LaBrie, 2005), or even find a positive association (Bailey & Swallow, 2004; Davis et al., 2013).

As may be observed, studies that analyse the association between psychotic-like experiences and substance use in non-clinical samples of young adults are inconsistent. Furthermore, the role of negative psychotic-like experiences has not yet been studied in depth. Therefore, it is necessary to carry out new research to understand and explore the relationship between these types of attenuated experiences and substance use, during the developmental stage of young adulthood, especially vulnerable for psychosis. Within this research context, the main purpose of this study was to examine the relationship between psychotic-like experiences and substance use in a young adult sample of college students. The hypothesis is that a high percentage of individuals will report substance use and attenuated psychotic experiences. Likewise, in accordance with previous studies, another hypothesis is that substance users will present a higher frequency of psychotic-like experiences, both positive and negative, in comparison with non-users, and that this association will be stronger with cognitive-perceptual psychotic-like experiences.

## Method

### Participants

An incidental sample of college students has been used. The sample was comprised of 660 participants, 195 males (29.5%), pursuing different courses of study at the University of Oviedo (Teaching, Criminology, Psychology, Medicine, Speech-Language Pathology, Computer Science, Economics and Physiotherapy). The average age of the participants was 20.3 years ( $SD = 2.6$ ), ranging between the ages of 17 and 30. The average number of years of education was 16.8 ( $SD = 2.3$ ). As regards civil status, 81.6% of the sample was single, 16.2% was married, 0.6% was divorced and 1.7% left this status unreported. As regards employment, 86.6% of the participants were unemployed, 12.6% were employed, and 1.2% left employment status unreported. The criteria for exclusion from this study was: a) presence of a serious mental illness (e.g., psychosis, bipolar disorder); and b) presence of a neurological disorder.

### Instruments

*Questionnaire on substance use.* To evaluate substance use, a series of *ad hoc* questions referring to the use of alcohol and drugs were formulated, specifically: cannabis, inhalants, cocaine, designer drugs and heroine/morphine. As regards alcohol consumption, data was gathered to classify the participants as non-drinker, drinker or ex-drinker. Participants classified as drinkers were asked to specify the amount of alcohol consumed in grams per day, in four categories: less than 10, between 11 and 20, between 21 and 50 and more

than 51. Likewise, information was also gathered on other substances, such as Cannabis/Marihuana/Hashish, Inhalants, Cocaine, Designer drugs/Methamphetamines/Ecstasy/LSD and Heroine/Morphine. For each, information was collected as to age of initial use in years, duration of use in months and days of use in the last month. These questions were formulated in line with earlier studies (Dumas et al., 2002; Najolia et al., 2012) and used scales that were previously validated (Soto-Brandt et al., 2014).

*Evaluation Scale for the Community Assessment Psychic Experiences-42 (CAPE-42)* (Stefanis et al., 2002). The CAPE is comprised of 42 items that evaluate three dimensions of psychotic symptoms: Positive (20 items), Negative (14 items) and Depressive (8 items). Each question is answered on a Likert scale of four points ranging from *Almost never* (1) to *Almost always* (4). When the participant selects the answers *Sometimes*, *Often* or *Nearly always*, the level of distress that results of that experience must also be indicated on a Likert scale of four points (0 = *Not distressed*; 3 = *Quite distressed*). This study used the version adapted to Spanish and validated in accordance with international standards (Muñiz, Elosua, & Hambleton, 2013). Scores obtained in previous studies present suitable levels of reliability and different evidences of validity (Barragan, Laurens, Blas Navarro, & Obiols, 2011; Fonseca-Pedrero et al., 2011; Fonseca-Pedrero, Paino, Lemos-Giráldez, & Muñiz, 2012b).

*Peters et al Delusions Inventory-21 (PDI-21)* (Peters, Joseph, Day, & Garety, 2004). The PDI-21 is a self-report designed to assess delusional experiences and propensity for delusions. The PDI comprises 21 items with dichotomous Yes/No answers. The total score is obtained by adding the positive responses of each item, wherefore the maximum possible score is 21 points. A higher score is indicative of greater delusional symptoms or propensity for delusions. Likewise, each item has three subscales measuring the degree of conviction, preoccupation and distress. These three subscales are scored using a Likert scale with five categories (1-5). This study used the Spanish version of the PDI-21, with suitable psychometric properties (Fonseca-Pedrero, Paino, Santarén-Rosell, Lemos-Giráldez, & Muñiz, 2012; López-Ilundain, Pérez-Nievas, Otero, & Mata, 2006).

*State-Trait Anxiety Inventory (STAI)* (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). The STAI is a self-report comprised of 40 items designed to evaluate two independent concepts of anxiety: State and Trait. Each scale is comprised of a total of 20 items with a Likert answer scale of four points according to intensity (0 = *Almost never/Not at all*; 3 = *Very much so/Almost always*). The total score for each scale ranges between 0-60 points. This study used the Spanish version of the STAI (Spielberger, Gorsuch, & Lushene, 2008). The Spanish version presents internal consistency levels that range between 0.84-0.93, and its validity has been analysed previously (Fonseca-Pedrero, Paino, Lemos-Giráldez, & Muñiz, 2012a; Guillén-Riquelme & Buéla-Casal, 2011).

## Procedure

The instruments were administered to the sample as a group, in groups of 10 to 45 students, during in-class hours and in a room prepared for this purpose. The study was presented to the participants as a research project on diverse personality traits, guaranteeing the confidentiality of their answers as well as the voluntary nature of their participation. Self-reports were always administered under the supervision of a researcher. All participants gave their informed consent to participate in the research project. This study is framed within a line of research related with early detection of serious psychological disorders in young adults. The study was approved by the Ethics Committee of the University of Oviedo.

## Data analysis

First, descriptive statistics were calculated for the PDI-21 and the CAPE-42 instruments. Second, the prevalence of self-reported psychotic experiences and substance use were analysed. Third, different Multivariate Analysis of Covariance (MANCOVA) were performed, controlling the effect of the covariables gender, anxiety state and anxiety trait. Scores on the PDI-21 and the CAPE-42 were the dependent variables, while use and non-use of substances were the independent variables, as well as global dichotomous polydrug use (non-users versus users of some type of substance). Given their low prevalence in this study, the effects of neither inhalants nor heroine were analysed. Wilks's  $\Lambda$  value was used to estimate possible statistically significant differences between all variables. The effect size was calculated using the partial  $\eta^2$  (partial  $\eta^2$ ).

Fourth, scores obtained in the PDI-21 and the CAPE-42 were dichotomized to carry out different hierarchical binary logistic regression analyses. Participants with scores equal to or greater than the 90th percentile, or participants with a percentile equal to or lower than 10, were selected. The effects of gender, anxiety state and anxiety trait were also controlled. Covariables were introduced in the first step of the model. The fixed variables selected were consumption of alcohol, cannabis, cocaine and designer drugs. The method for estimation used was the Forward Wald; the odds ratio and its confidence interval (95%) were calculated. The Hosmer Lemeshow test was used to evaluate the goodness of fit of the binary logistic regression model. The SPSS Statistics 15.0 package was used for data analysis (*Statistical Package for the Social Sciences*, 2006).

## Results

### Descriptive statistics and prevalence of psychotic-like experiences and substance use

The descriptive statistics referred to the scores obtained in the CAPE-42 may be consulted in a previous study (Fonseca-Pedrero, Paino, et al., 2012b). The statistics of the PDI-21 were:  $M=4.30$ ;  $SD=2.18$ ; range 0-18; Cronbach's  $\alpha=0.91$ .

The percentage of participants that responded affirmatively (*Often* or *Almost always*) in the answer options of the positive dimension of the CAPE-42 ranged between 0.6% (item 24) and 20.3% (item 6), though it is true that almost all of the percentages were close to 2%. In the PDI-21, 96% of the participants positively reported having experienced delusions at least once.

In relation to substance use, participants reported the following: A total of 32.4% ( $n=215$ ) of the participants considered themselves drinkers. The percentage by type of consumption for drinking was: 26.1% ( $n=172$ ) under 10 g/day, 3.5% ( $n=23$ ) between 11-20 g/day, 1.8% ( $n=12$ ) 21-50 g/day, 0.3% ( $n=2$ ) over 51 g/day and 0.9% ( $n=6$ ) ex-drinker. A total of 20.2% ( $n=133$ ) of the sample reported using cannabis, 0.6% ( $n=4$ ) inhalants, 7.7% ( $n=51$ ) cocaine, 2.6% ( $n=17$ ) designer drugs, and 0.2% ( $n=1$ ) heroine. In global terms, 41.1% of the sample reports some type of substance use, distributed as follows: 0 = 58.9% ( $n=153$ ), 1 = 23.2% ( $n=153$ ), 2 = 14.4% ( $n=95$ ), 3 = 2.3% ( $n=15$ ), 4 = 1.1% ( $n=7$ ), and 5 = 0.2% ( $n=1$ ). As to consumption, disregarding substances with lower prevalence (heroine and inhalants), the number of substances was distributed as follows: 0 = 58.9% ( $n=389$ ), 1 = 24.2% ( $n=153$ ), 2 = 14.7% ( $n=97$ ), 3 = 2.3% ( $n=15$ ), and 4 = 0.9% ( $n=6$ ). If only the consumption of the substances cannabis, cocaine and designer drugs are considered, 75% of the sample reported no consumption.

Consumption patterns showed differential variations depending on gender for alcohol consumption (dichotomized consumption vs. non-consumption) ( $\chi^2(1) = 30.78$ ,  $p = 0.001$ ), cannabis ( $\chi^2(1) = 21.31$ ,  $p = 0.001$ ), inhalants ( $\chi^2(1) = 9.59$ ,  $p = 0.001$ ), and designer drugs ( $\chi^2(1) = 4.58$ ,  $p = 0.032$ ). In these cases, reported substance use was higher in males than in females. Statistically significant differences were not found neither in cocaine use ( $\chi^2(1) = 1.57$ ,  $p = 0.209$ ) nor in heroin use ( $\chi^2(1) = 0.42$ ,  $p = 0.517$ ).

### Association between psychotic-like experiences and substance use

Then, the relationship between the subscales and the total scores obtained in the PDI-21 and the CAPE-42 and use or non-use of substances was analysed. Table 1 presents the mean scores depending on use, as well as global polydrug use. The results showed statistically significant differences in a majority of the comparisons carried out. The Wilks's  $\lambda$  value revealed statistically significant differences depending on the factors Alcohol ( $\lambda = 0.974$ ,  $F(4.652) = 4.289$ ,  $p = 0.002$ , partial  $\eta^2 = 0.026$ ), Cannabis ( $\lambda = 0.971$ ,  $F(4.652) = 4.90$ ,  $p = 0.001$ , partial  $\eta^2 = 0.029$ ), Designer drugs ( $\lambda = 0.978$ ,  $F(4.652) = 3.735$ ,  $p = 0.005$ , partial  $\eta^2 = 0.022$ ), and total use ( $\lambda = 0.969$ ,  $F(4.652) = 5.130$ ,  $p < 0.001$ , partial  $\eta^2 = 0.031$ ). Statistically significant differences were not found for the Cocaine factor ( $\lambda = 0.961$ ,  $F(4.652) = 4.010$ ,  $p = 0.348$ , partial  $\eta^2 = 0.007$ ). In any case, the substance user group obtained

Table 1. Mean scores in the Peters et al. Delusions Inventory-21 (PDI-21) and in the Community Assessment Psychic Experiences-42 (CAPE-42), per substance use

	PDI-21 Total		CAPE-42 Positive		CAPE-42 Depressive		CAPE-42 Negative		CAPE-42 Total	
	Use	Non-use	Use	Non-use	Use	Non-use	Use	Non-use	Use	Non-use
Alcohol										
Mean	3.95	5.02	24.53	26.15	13.38	13.73	22.62	23.51	60.52	63.38
SD	2.60	3	3.56	5.76	2.67	2.98	4.57	4.93	8.69	10.56
Cannabis										
Mean	4.04	5.32	24.71	26.42	13.42	13.78	22.69	23.75	60.82	63.95
SD	2.58	3.27	3.86	6.12	2.79	2.73	4.59	5.08	8.88	11.05
Cocaine										
Mean	4.24	5.04	24.94	26.37	13.46	13.88	22.89	23.08	61.29	63.33
SD	2.81	2.24	4.38	5.11	2.81	2.41	4.75	4.14	9.48	8.73
Designer drugs										
Mean	4.27	5.47	24.96	28.47	13.49	13.47	22.93	22.06	61.38	64
SD	2.77	2.85	4.35	6.78	2.79	2.29	4.72	4.1	9.43	9.51
Any use										
Mean	3.84	4.96	24.39	26.01	13.32	13.73	22.45	23.56	60.16	63.31
SD	2.56	2.95	3.44	5.47	2.72	2.85	4.59	4.8	8.67	10.16

Note. SD: Standard Deviation; Alcohol: Non-use n = 445, Use n = 215; Cannabis: Non-use n = 527, Use n = 133; Cocaine: Non-use n = 609, Use n = 51; Designer drugs: Non-use n = 643, Use n = 17; Any use: Non-use n = 389, Use n = 217.

higher total mean scores in the PDI-21 and the CAPE-42, compared with the non-user group.

The results of the univariate analysis of variance showed statistically significant differences for the Alcohol factor in all scores, with the exception of the depressive dimension of the CAPE-42 ( $p < 0.05$ ). As to the alcohol consumption pattern (depending on g/day), statistically significant differences were found between the different groups ( $\lambda = 0.933$ ,  $F(20,2150) = 2.284$ ,  $p < 0.001$ , partial  $\eta^2 = 0.017$ ). Specifically, statistically significant differences were found in the total score of the PDI-21 ( $F(5,651) = 5.946$ ,  $p < 0.001$ , partial  $\eta^2 = 0.044$ ) in its Positive dimension ( $F(5,651) = 4.604$ ,  $p < 0.001$ , partial  $\eta^2 = 0.011$ ), and in the total score obtained in the CAPE-42 ( $F(5,651) = 3.899$ ,  $p < 0.001$ , partial  $\eta^2 = 0.029$ ). The tendency found was that non-drinkers obtained lower mean scores compared with the remaining groups (except for ex-drinkers or more than 50 g/day), and that the user group of 21-50 g/day obtained higher mean scores compared with the rest of the groups. As to use of cannabis and total polydrug use, participants who positively reported use also obtained higher mean scores in the mentioned self-reports, compared with the substance non-user group ( $p < 0.05$ ). On the other hand, participants who reported designer drug use only presented statistically higher mean scores compared with non-users in the positive dimension of the CAPE-42 ( $F(4,652) = 7.183$ ,  $p < 0.001$ , partial  $\eta^2 = 0.011$ ).

### Prediction of psychotic-like experiences and substance use

Finally, different binary logistic regression analyses were performed, selecting those participants who obtained extreme scores in the PDI-21 and the CAPE-42. The effects of gender, anxiety state and anxiety trait were also controlled. Table 2 displays the results of the binary logistic regression analyses. As shown, the variable alcohol use was statistically significant in the majority of the estimated models. Cannabis use only predicted the total score for participants with extreme scores in the PDI-21. None of the different types of substance use resulted in statistically significant predictions of scores in the negative dimension of the CAPE-42. Cocaine and designer drugs failed to predict extreme scores in neither the PDI-21 nor the CAPE-42.

### Discussion and conclusions

The main goal of this study was to examine the relationship between psychotic-like experiences and substance use in a sample of college students. The results showed that 96% of the sample reported some type of experience of delusional ideation, while 20.3% reported at least one positive type of psychotic-like experience. Furthermore, 41.1% of the sample reported some type of substance use. Participants who were users of any substance, with the exception of cocaine,

Table 2. Binary logistic regression models for substance use that predict extreme scores in the PDI-21 and the CAPE-42, controlling for the effect of gender and anxiety

Variable	Use type	B	Standard error	Wald	g.l.	p	Odds ratio	Confidence interval 95%	R <sup>2</sup> Nagelkerke
PDI-21 Total									
	Alcohol	3.161	0.787	16.12	1	0.001	23.59	5.04-110.30	0.557
	Cannabis	1.434	0.677	9.48	1	0.034	4.195	1.112-15.22	0.591
CAPE Positive									
	Alcohol	0.875	0.444	3.875	1	0.049	2.399	1.004-5.371	0.457
CAPE Depressive									
	Alcohol	2.230	0.077	9.073	1	0.003	10.172	2.248-46.018	0.831
CAPE Total									
	Alcohol	1.572	0.747	4.429	1	0.035	4.816	1.114-20.822	0.796

reported a higher number of subclinical psychotic experiences, especially of a cognitive-perceptual type. Likewise, alcohol use predicted, in most cases, extreme scores on measures of delusional ideation (PDI-21) and of psychotic-like experiences (CAPE-42). These findings seem to support dimensional models of the psychotic phenotype and enable for increasing our understanding of the relationship between psychotic-like experiences and substance use in non-clinical young adults.

First, the findings of this study indicate that psychotic experiences are not strictly limited to the clinical population, but rather may be normally distributed among the general population, below the clinical threshold, suggesting the possibility of a continuum between clinical and subclinical phenotypes of psychosis (Linscott & van Os, 2013; van Os et al., 2009). Previous studies have reached similar conclusions, analysing both non-clinical adolescents and adults of the general population (Debbané et al., 2015; Fonseca-Pedrero, Santarén-Rosell, Paino, & Lemos Giraldez, 2013; Ibáñez-Casas et al., 2015; McGrath et al., 2015). For example, a study carried out by McGrath et al. (2015), with a sample of 31,261 adults from 18 countries, found that the average prevalence of psychotic-like experiences was of 5.8%, with hallucinations experienced by 5.2% and delusional experiences by 1.3%. Likewise, substance use was quite common among this sample, with results similar to, or even lower than, those reported in previous studies (Fumero et al., 2009; Hernández-Serrano, Font-Mayolas, & Gras, 2015). According to the 2013/2014 Home-based Interviews on Alcohol and other Drugs (EDADES, 2015), the most-used drugs are alcohol (78.3% have consumed alcohol in the last twelve months), tobacco (40.7%) and hypnotosedatives (12.2%). Likewise, as to the use of cannabis, 9.2% of those surveyed reported having tried it *at least once over the last year*, while

6.6% *at least once over the last month*. Specifically, 2.2% of the Spanish population meets the required criteria for diagnosing problematic cannabis use.

Second, participants who used some type of substance, with the exception of cocaine, reported a higher number of attenuated psychotic experiences. Specifically, effect sizes were higher for use of alcohol and cannabis. The results of this study are convergent with those reported in earlier publications on psychotic-like experiences (Barkus et al., 2006; Mackie et al., 2013; Saha et al., 2011; Schubart et al., 2011; van Os et al., 2002), as well as schizotypy (Barkus et al., 2006; Davis et al., 2013; Fumero et al., 2009; Najolia et al., 2012; Nunn et al., 2001). For example, Saha et al. (2011) found that psychotic-like delusional experiences were related with a higher use of tobacco, cannabis, and alcohol. Likewise, participants with disorders due to cannabis use were more prone to report subclinical psychotic experiences. This association was more prominent in individuals with an age of initial use of 16 years or under. To the contrary, the pattern of association between delusional experiences and alcohol use or dependence were less consistent. Nevertheless, individuals with disorders due to alcohol use at an early age were more prone to report these types of psychotic-like experiences (Saha et al., 2011).

Per these results, participants that use substances report more psychotic-like experiences when compared with non-users, though the nature of the association is unclear and is, apparently, quite complex. Different hypotheses may be proposed. It is possible that those participants with these types of experiences recur to substances to mitigate or alleviate their impact (e.g., dysphoria, self-medication or reverse causation). Likewise, it is plausible that the substance use itself predisposes the user for psychotic experiences (causal relationship). Also, the existence of a bidirectional

relationship is possible (a combination of both hypotheses) or that, simply, an association exists. In this regard, current models consider that the relationships between substance use and psychotic experiences, symptoms, and disorders are complex, dynamic, and multifactorial (e.g., age of initial use, frequency of use, protective factors, family history of disorders), as the paths for developing heterogeneous psychotic symptoms (Henquet, Di Forti, Morrison, Kuepper, & Murray, 2008).

Third, the results derived of the logistic regression analyses prove that alcohol use, once having controlled for the effect of certain covariables, was the most powerful predictive variable for the group with extreme scores in psychotic-like experiences. In almost all of the cases, high odds ratio were found. Compared with the remaining patterns, alcohol users with a moderate-high consumption (21-50 g/day) obtained the highest average scores. Given the reduced sample size in this study, conclusive data cannot be drawn for the severe consumption group (more than 50 g/day). Likewise, the association between type of consumption and psychotic-like experiences revealed a differentiated pattern, detecting a stronger association with cognitive-perceptual psychotic-like experiences and a weaker one with negative psychotic-like experiences. Previous studies analysing the role of negative traits of schizotypy or negative psychotic-like experiences yielded similar, though inconsistent, results. For example, some studies reflect the existence of an association between the negative dimension and use of drugs on a subclinical level (Bailey & Swallow, 2004; Davis et al., 2013); however, it is likewise true that other studies indicate that users of cannabis and alcohol obtain lower scores on the negative dimension of schizotypy in comparison with non-users (Nunn et al., 2001; Skosnik et al., 2008), or do not find this association (Barkus et al., 2006; Dumas et al., 2002; Fridberg et al., 2011; Schiffman et al., 2005). In general terms, these results seem to reveal the existence of a differentiated pattern of association between this series of experiences and subclinical psychotic traits and substance use (e.g., use, frequency and age of initial use), though this issue requires further research given that results vary depending on the type of study, sample, measurement instruments, and statistical analysis performed.

These types of psychotic-like experiences could be combined with other risk markers, such as, for example, substance use and abuse, stress, trauma or growing up in an urban environment (van Os et al., 2010), to examine possible underlying aetiological mechanisms of disorders of the psychotic spectrum (Henquet et al., 2008). Some theoretical models hypothesize that the cumulative or synergic presence of different environmental risk factors, depending on an individual's developmental stage and predisposition or vulnerability, may favour the transformation of certain psychotic-like experiences into abnormally persistent ones, in the future comprising clinical symptoms and the subsequent need for

treatment (Cougnaud et al., 2007). For example, epidemiological studies have found that the start of using cannabis in adolescence increases the probability of psychotic symptoms and disorders during adulthood (Arseneault et al., 2002) and contributes to their persistence over time (Mackie et al., 2013). In the same way, it seems that when the use of cannabis interacts with other risk factors, such as traumatic experiences, the likelihood of having psychotic symptoms increases (Cougnaud et al., 2007; Harley et al., 2010). Other models, based on studies using animals, also postulate on the effect that cannabinoids may cause on different dopamine and/or cannabinoid receptors (especially at the level of the prefrontal cortex, striate cortex and hippocampus), as well as with regards to their capacity for modifying the glutamatergic system and for triggering a wave of biochemical changes, perhaps neurotoxic and, likewise, increasing the risk for developing psychotic disorders (Bossong & Niesink, 2010; Rocchetti et al., 2013).

The following limitations must be taken into account when interpreting the results of this study. First, the use of an incidental sample of college students, mostly female. In this regard, the characteristics of the sample affect the validity of the results, as well as their possible generalisation to other populations of interest. Second, the problems inherent to self-reporting, wherefore the use of external reporters would have been interesting (e.g., interviews) to analyse the presence of mental disorders among study participants, or laboratory measures (e.g., blood analyses) to verify substance use. Third, the transversal nature of this study cannot be overlooked, which prevents the possibility of inferring cause-effect relationships. Fourth, substance use has been associated with neurocognitive deficits (López-Caneda et al., 2014) and physiological effects (Vinader-Caerols, Monleon, & Parra, 2014), aspects that may modulate the results. Finally, the administration of measurement instruments for analysing the depressive affective state would have been interesting.

Future research should perform longitudinal studies and determine the predictive value of substance use in developing disorders along the psychotic spectrum and include neuroscientific models accounting for complex and dynamic interactions established in the gene x environment interaction, for purposes of improving early detection strategies and for the early detection and identification of individuals at risk of these disorders.

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