

BMJ Open Factors related to risky alcohol consumption and binge drinking in Spanish college students: a cross-sectional study

Enrique Ramón-Arbués,^{1,2} Isabel Antón-Solanas ,^{1,3}
Isabel Rosario Blázquez-Ornat,^{1,3} Piedad Gómez-Torres ,^{1,3}
Loreto García-Moyano,⁴ Eva Benito-Ruiz^{1,3}

To cite: Ramón-Arbués E, Antón-Solanas I, Blázquez-Ornat IR, *et al.* Factors related to risky alcohol consumption and binge drinking in Spanish college students: a cross-sectional study. *BMJ Open* 2025;**15**:e089825. doi:10.1136/bmjopen-2024-089825

► Prepublication history for this paper is available online. To view these files, please visit the journal online (<https://doi.org/10.1136/bmjopen-2024-089825>).

Received 10 June 2024
Accepted 13 January 2025



© Author(s) (or their employer(s)) 2025. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ Group.

¹B53_23R: SAPIENF, Zaragoza, Spain

²Universidad San Jorge, Villanueva de Gallego, Zaragoza, Spain

³Facultad de Ciencias de la Salud, Universidad de Zaragoza, Zaragoza, Spain

⁴Escuela Universitaria de Enfermería de Huesca, Universidad de Zaragoza, Zaragoza, Spain

Correspondence to

Dr Isabel Antón-Solanas;
ianton@unizar.es

ABSTRACT

Objectives The aim of this study was to determine the prevalence of risky alcohol consumption and regular binge drinking, and their associated factors, in Spanish college students.

Design A cross-sectional study was conducted.

Setting This study took place at a private university in a northern region of Spain.

Participants A total of 330 Spanish undergraduate university students enrolled in the 2022–2023 academic year voluntarily agreed to participate in this investigation.

Primary and secondary outcome measures Data collection included sociodemographic information and health-related behaviours. The Alcohol Use Disorders Identification Test was used to assess alcohol consumption. Logistic regression models were used to identify independent predictors for risky alcohol consumption and regular binge drinking.

Results 40.0% of participants reported risky alcohol consumption, and 26.7% were classified as regular binge drinkers. Factors associated with risky alcohol consumption included smoking (OR=3.54, 95% CI 2.03 to 6.14) and problematic internet use (OR=2.10, 95% CI 1.24 to 3.53). Conversely, being older than 30 years was associated with a lower likelihood (OR=0.22, 95% CI 0.08 to 0.60). Regular binge drinking was associated with living outside the family home (OR=2.78, 95% CI 1.56 to 4.95), smoking (OR=3.53, 95% CI 1.94 to 6.40) and problematic internet use (OR=2.19, 95% CI 1.23 to 3.89). In contrast, being female (OR=0.50, 95% CI 0.27 to 0.94) and being over 30 years old (OR=0.28, 95% CI 0.10 to 0.86) were inversely associated.

Conclusions Risky alcohol consumption and binge drinking are relatively common among Spanish university students. Interventions to promote responsible alcohol consumption among this population should be implemented in collaboration with other stakeholders.

BACKGROUND

Harmful use of alcohol is a causal factor of more than 200 known health problems, including non-communicable diseases, mental and behavioural disorders, and injuries capable of causing death and disability.¹

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ We used the Alcohol Use Disorders Identification Test, a validated and widely used tool for measuring alcohol consumption, which guarantees the validity and comparability of the data.
- ⇒ This study encompasses a comprehensive range of socio-demographic and behavioural variables, facilitating a detailed examination of the factors associated with alcohol consumption.
- ⇒ The use of logistic regression models allowed the identification of predictors independently associated with risky alcohol consumption and binge drinking.
- ⇒ The cross-sectional design of the study does not allow us to determine causal relationships, which prevents us from inferring the direction of the observed associations.
- ⇒ Participants were recruited from a single university, which may limit the external validity of the findings.

Globally, alcohol use is the most prevalent of all substance use disorders and stands as the seventh risk factor for both death and disability-adjusted life years (DALYs). Moreover, in the population under 50 years of age, alcohol consumption is the main global risk factor, causing 8.9% of all attributable DALYs in men and 2.3% in women; and 12.2% of all deaths in men and 3.8% in women.²

Effective alcohol control policies have important economic and public health benefits, but their development and implementation is, to date, uneven and not in proportion to the harm caused by alcohol.³ Any effective action requires a coordinated approach with special emphasis on monitoring risk groups and early detection of risky alcohol consumers.⁴ One of these groups is the young adult population, strongly represented in the university student community. Furthermore, it has been documented that the highest prevalence of inappropriate alcohol consumption

and binge drinking occurs in the population aged 18–24,⁵ with college students consuming more alcohol than their non-student peers.⁶

The university population is an important target audience for public health actions. Entering university is a new challenge which, often, brings about important changes in terms of health-related behaviours. Peer competition, pressure for academic success, changes in workload and support networks, new types of relationships and living away from home are all stressors that can trigger new risky behaviours and compromise future health.⁷ Yet, college years are a crucial time for the acquisition and reinforcement of positive behaviours that impact on health and well-being. Specifically in relation to alcohol consumption, college is the time to cement previously learnt behaviours, or to acquire new behaviours that replace the old ones.⁸

Many variables may influence college students' relationship with alcohol, including individual factors (eg, personality),⁹ support networks (eg, influence of peers or dysfunctional family),^{10–12} the local environment (eg, accessibility or attractiveness and cost of certain alcoholic beverages),^{12–13} as well as the macro environment (eg, advertising).¹⁴ Other sociodemographic variables have also been linked to college students' alcohol consumption. Among them are living alone,¹⁰ male genders,¹⁵ satisfaction with studies and poor academic performance¹⁶ and psychological distress.¹⁷ However, it is important to take into account that although alcohol consumption varies over time¹⁸ and cultures¹⁹ and, therefore, periodic diagnostic approaches, specific to each geographical and cultural context, may be necessary.²⁰ To date, the study of alcohol consumption in the Spanish university population is scarce and it is often based on institutional registries with non-standardised detection criteria.²¹ In order to address this research gap, the present study aimed to determine the prevalence of risky alcohol consumption and binge drinking, as well as to analyse the predictive factors associated with these behaviours, in a sample of Spanish college students enrolled in undergraduate studies in 2023.

METHODS

Studio design and location

A cross-sectional descriptive study was carried out on a sample of students enrolled in any of the undergraduate degrees taught at Universidad San Jorge (USJ) in Aragon (Spain). A STROBE checklist was completed. All the participants were informed about the study aims, methods and procedures before giving their informed consent to participate. All the participants were assured that participation was voluntary and that consent to participate could be withdrawn at any time without giving any reason and without negative consequences to themselves and/or their academic results. The procedures used to carry out this study followed the ethical principles stated in the

Helsinki Declaration by the World Medical Association in 1964 (updated 2008).

Sample Population

The minimum sample size was calculated based on the total number of students enrolled in undergraduate studies at USJ ($n=3810$), and the results obtained by Herrero-Montes *et al* (2022) through the Alcohol Use Disorders Identification Test (AUDIT) in a sample of university students in Cantabria (Northern Spain). Thus, for a 95% CI and a 5% margin of error, the minimum sample size was estimated at 319 participants.

All students enrolled in any degree programme at USJ were eligible to participate in the study, with no additional inclusion or exclusion criteria. The study was initially publicised to students via institutional newsletters, posters and the university's social media pages throughout December 2022. Secondly, between January and March 2023, the students were informed on a classroom-by-classroom basis. Finally, students interested in participating could do so via an online survey (Microsoft Forms with access via QR code), which was accessible until 31 March 2023. Prior to commencing the questionnaire, participants were required to read an explanatory text outlining the characteristics of the research project, including the objectives, potential risks and benefits, the anonymous treatment of their data, and their rights as participants.

A total of 361 undergraduate college students voluntarily agreed to participate and completed the questionnaire (response rate 9.5%). Of the 361 questionnaires received, 31 were excluded as they did not meet minimum quality criteria (generalised absence of data or manifestly unrealistic data) (rejection rate 7.6%).

Variables and instruments used for data collection

The questionnaire was divided into two sections. The first section included sociodemographic data, namely age, gender, residence, employment and branch of studies. The second section included information about the participants' internet use, diet quality, physical activity and tobacco consumption (smoker vs non-smoker) and alcohol intake.

Internet use was evaluated using Young's Internet Addiction Test (IAT), validated for the Spanish university population with adequate psychometric properties (reliability scores: $r=0.899$, $Kappa=0.650$).²² The IAT comprises 20 items measured on a 1–5 Likert scale. Total scores range from 20 to 100. Scores <50 have been associated with controlled internet users; scores 50–79 have been associated with problematic internet users (PIU), scores ≥ 80 have been associated with significant vital problems arising from PIU.²³ In this study, the total score from this questionnaire was dichotomised into normal internet use (IAT <50) and PIU (IAT ≥ 50).²⁴

Physical activity was assessed through the International Physical Activity Questionnaire-Short form (IPAQ-SF).

IPAQ-SF evaluates the intensity, frequency and duration of physical activity in the last 7 days. According to the IPAQ-SF's official protocol for interpreting the results,²⁵ respondents are classified into three levels of activity, namely low, moderate and high. The IPAQ-SF has been validated in the population of Spanish college students and shows a satisfactory correlation ($r=0.69$) with the results obtained using accelerometers.²⁶

Participants' diet was assessed using the Spanish Healthy Eating Index (SHEI).²⁷ This tool was adapted from the Healthy Eating Index²⁸ to the Spanish context according to the recommendations of the Spanish Society of Community Nutrition. The SHEI comprises 10 items measured on a 0–10 scale, with final scores ranging from 0 to 100 points. Based on the total score, participants are categorised as follows: score >80 (healthy diet), 50–80 (diet in need of changes) and <50 (inadequate diet). The HEI tool has been validated through plasma biomarkers showing satisfactory correlation levels for its different items.²⁹ In this study, the total score was dichotomised into a healthy diet (SHEI >80) and an unhealthy diet (SHEI 0–80).

Finally, alcohol consumption was assessed using the AUDIT scale. This tool was originally developed by the World Health Organization (WHO). It comprises 10 items with total scores ranging from 0 to 40.³⁰ The AUDIT scale is composed of three distinct dimensions: hazardous drinking (items 1–3, referring to acute heavy drinking episodes), symptoms of dependence (items 4–6) and harmful drinking (items 7–10). In its Spanish version, the AUDIT scale has shown adequate psychometric properties for the early detection of alcohol consumption problems in Spanish university students when administered both face-to-face³¹ and online.³² The AUDIT tool has historically utilised a cut-off point of 8 for the detection of risky alcohol consumption, irrespective of gender. However, in Spain, the cut-off points for the detection of risky alcohol consumption in the population of male and female Spanish college students are set at 8 and 6 points, respectively. Additionally, scores of 13 and above indicate harmful alcohol consumption in both genders.³¹ The term 'risky alcohol consumption' is used to describe patterns of drinking that are potentially harmful to health. These patterns often involve a higher risk of developing health problems and may require reduction. The condition of 'harmful alcohol consumption' is used to describe regular drinking that is causing harm to physical and/or mental health. In such cases, professional support is often necessary to assist with reduction.

The variable binge drinking was extracted from the questions: 'how often do you have six or more drinks on one occasion?', for men, and 'how often do you have five or more drinks on one occasion?', for women. We classified participants as being regular binge drinkers if their answer to either of these questions was daily or almost daily, weekly or monthly.

Data analysis

We used mean, standard deviation (SD), and interquartile range (IQR) to analyse quantitative variables, and count and percentage to analyse categorical ones. A bivariate analysis comparing the sociodemographic variables with the type of alcohol consumption was carried out using the χ^2 test (or Fisher's exact test). In addition, we analysed the results from the AUDIT scale from a gender perspective. Specifically, the total AUDIT score as well as subdimension mean scores of male and female participants were compared using the Mann-Whitney test. Finally, two binary logistic regression models (*Enter method*) were carried out in order to determine the predictors of risky alcohol consumption (AUDIT score ≥ 8 in men and ≥ 6 in women) and regular binge drinking. All calculations were performed using the *Statistical Package for the Social Science* (SPSS) V.23.0, accepting as statistically significant a value of $p < 0.05$.

Patient and public involvement

Undergraduate students were first involved in the research at the time of being informed about the study aims and procedures and giving their voluntary informed consent to participate. The research questions were developed based on previous, extensive research carried out by the research team on college students' health and health risks. The participants' involvement was limited to data collection. Following university policy, the results from this investigation are available to them on request.

RESULTS

The final sample comprised a total of 330 students. 56.1% of the students were women, 63.0% were aged 18–21 and 52.7% lived with their families. Just over half of the participants were enrolled in health sciences programmes, and approximately two-thirds of our sample were unemployed. Regarding the students' habits or behaviours, 40% of the participants showed a low level of physical activity, 32.4% displayed PIU, 29.4% were smokers and 11.5% followed an inadequate diet (see [table 1](#)).

Alcohol consumption was assessed through the AUDIT scale. 40.0% of participants reported problematic alcohol consumption (24.8% risky consumption and 15.2% harmful alcohol consumption). In addition, 26.7% of the participants engaged in binge drinking behaviours at least monthly ([table 2](#)).

The gender analysis of alcohol consumption demonstrated a higher consumption rate among male subjects, accompanied by a higher prevalence of acute heavy drinking (hazardous alcohol use domain of the AUDIT scale) ([tables 2 and 3](#)).

Logistic regression analysis for the determination of predictors of risky alcohol consumption showed that older age (≥ 30 years) was associated with more judicious consumption (OR=0.22; 95% CI 0.08 to 0.60). Conversely, smoking (OR=3.54; 95% CI 2.03 to 6.14) and PIU (OR=2.10; 95% CI 1.24 to 3.53) predicted risky alcohol consumption. In

Table 1 Characteristics of the participants based on their alcohol intake

	Total (n=330)		No risky consumption (n=198)		Risky consumption (n=82)		Harmful alcohol consumption (n=50)		P value*
	N	%	N	%	N	%	N	%	
Age									
18–21 years	208	63.0	121	58.2	54	26.0	33	15.9	0.083
22–29 years	82	24.8	45	54.9	22	26.8	15	18.3	
≥30 years	40	12.1	32	80.0	6	15.0	2	5.0	
Gender									
Male	145	43.9	86	59.3	27	18.6	32	22.1	0.002
Female	185	56.1	112	60.5	55	29.7	18	9.7	
Studies									
Health sciences	186	56.4	110	59.1	42	22.6	34	18.3	0.158
Other	144	43.6	88	61.1	40	27.8	16	11.1	
Residence									
Family home	174	52.7	111	63.8	42	24.1	21	12.1	0.195
Away from family home	156	47.3	87	55.8	40	25.6	29	18.6	
Employment									
Yes	107	32.4	63	58.9	24	22.4	20	18.7	0.424
No	223	67.6	135	60.5	58	26.0	30	13.5	
Smoking									
Yes	97	29.4	38	39.2	29	29.9	30	30.9	0.000
No	233	70.6	160	68.7	53	22.7	20	8.6	
Internet use									
Normal use	223	67.6	147	65.9	44	19.7	32	14.3	0.003
PIU	107	32.4	51	47.7	38	35.5	18	16.8	
Physical activity									
High	111	33.6	69	62.2	19	17.1	23	20.7	0.054
Moderate	87	26.4	55	63.2	21	24.1	11	12.6	
Low	132	40.0	74	56.1	42	31.8	16	12.1	
Diet quality									
Healthy	49	14.8	36	73.5	8	16.3	5	10.2	0.002
In need of changes	243	73.6	149	61.3	61	25.1	33	13.6	
Inadequate	38	11.5	13	34.2	13	34.2	12	31.6	

*X² test.

PIU, problematic internet users.

addition, participants who did not live in the family home (OR=2.78; 95% CI 1.56 to 4.95), smokers (OR=3.53; 95% CI 1.94 to 6.40) and problematic internet users (OR=2.19; 95% CI 1.23 to 3.89) had a higher probability of being regular binge drinkers. In turn, older age (≥30 years) (OR=0.28; 95% CI 0.10 to 0.86) and being a woman were inversely associated with binge drinking (OR=0.50; 95% CI 0.27 to 0.94). The predictive capacity of both models was 20% (risky alcohol consumption model) and 23% (binge drinking model) (table 4).

DISCUSSION

This study has analysed the prevalence of risky alcohol consumption and binge drinking in a sample of Spanish university students from various academic courses and study programmes.

Our findings reveal high alcohol consumption in the study population, with 40.0% of students reporting risky consumption. Our results are even more concerning than those reported in a previous (pre-pandemic) study, which reported a prevalence of 20.1% and 6.4% of risky alcohol consumption and harmful alcohol consumption, respectively.³¹ This recent upward trend contrasts with the decline in alcohol consumption observed in Spain since 2011, following the enactment of new laws aimed at

Table 2 Characteristics of alcohol consumption by AUDIT items and gender

	Total (n=330)		Males (n=145)		Women (n=185)		
	N	%	N	%	N	%	P value*
How often do you have a drink containing alcohol?							
4 or more times a week	6	1.8	6	4.1	0	0.0	0.001
2–3 times a week	70	21.2	34	23.6	36	19.5	
2–4 times a month	153	46.4	69	47.6	84	45.4	
Monthly or less	77	23.3	22	15.2	55	29.7	
Never	24	7.3	14	9.7	10	5.4	
How many standard drinks containing alcohol do you have on a typical day when drinking?							
10 or more	3	0.9	2	1.4	1	0.5	0.016
7–9	17	5.2	13	9.0	4	2.2	
5–6	52	15.8	28	19.3	24	13.0	
3–4	120	36.4	46	31.7	74	40.0	
1–2	138	41.8	56	38.6	82	44.3	
How often do you have six or more (five or more in women) drinks on one occasion?							
Daily or almost daily	0	0.0	0	0.0	0	0.0	0.000
Weekly	28	8.5	21	14.5	7	3.8	
Monthly	60	18.2	26	17.9	34	18.4	
Less than monthly	104	31.5	56	38.6	48	25.9	
Never	138	41.8	42	29.0	96	51.9	
During the past year, how often have you found that you were not able to stop drinking once you had started?							
Daily or almost daily	3	0.9	2	1.4	1	0.5	0.177
Weekly	3	0.9	2	1.4	1	0.5	
Monthly	7	2.1	4	2.8	3	1.6	
Less than monthly	43	13.0	25	17.2	18	9.7	
Never	274	83.0	112	77.2	162	87.6	
During the past year, how often have you failed to do what was normally expected of you because of drinking?							
Monthly	10	3.0	4	2.8	6	3.2	0.143
Less than monthly	89	27.0	47	32.4	42	22.7	
Never	231	70.0	94	64.8	137	74.1	
During the past year, how often have you needed a drink in the morning to get yourself going after a heavy drinking session?							
Weekly	5	1.5	4	2.8	1	0.5	0.197
Monthly	9	2.7	4	2.8	5	2.7	
Less than monthly	21	6.4	6	4.1	15	8.1	
Never	295	89.4	131	90.3	164	88.6	
During the past year, how often have you had a feeling of guilt or remorse after drinking?							
Daily or almost daily	2	0.6	2	1.4	0	0.0	0.355
Weekly	4	1.2	2	1.4	2	1.1	
Monthly	29	8.8	16	11.0	13	7.0	
Less than monthly	122	37.0	52	35.9	70	37.8	
Never	173	52.4	73	50.3	100	54.1	
During the past year, how often have you been unable to remember what happened the night before because you had been drinking?							
Weekly	5	1.5	4	2.8	1	0.5	0.377
Monthly	34	10.3	15	10.3	19	10.3	
Less than monthly	114	34.5	52	35.9	62	33.5	
Never	177	53.6	74	51.0	103	55.7	
Have you or someone else been injured as a result of your drinking?							

Continued

Table 2 Continued

	Total (n=330)		Males (n=145)		Women (n=185)		P value*
	N	%	N	%	N	%	
Yes, during the last year	26	7.9	16	11.0	10	5.4	0.063
Yes, but not in the last year	21	6.4	12	8.3	9	4.9	
No	283	85.8	117	80.7	166	89.7	
Has a relative or friend, doctor or other health worker been concerned about your drinking or suggested you cut down?							
Yes, during the last year	25	7.6	14	9.7	11	5.9	0.401
Yes, but not in the last year	6	1.8	2	1.4	4	2.2	
No	299	90.6	129	89.0	170	91.9	
Bold values are statistically significant, p<0.05							
*X ² test.							

Bold values are statistically significant, $p < 0.05$

* χ^2 test.

reducing the consumption of both alcohol and tobacco.²¹ Previous studies carried out in the European context have reported similar results.^{33–35} However, the rate of problematic alcohol consumption is not stable, ranging from 13.8% in a large sample of French college students³⁶ to 38.0% in a sample of Spanish ones.³⁷ Caution should be exercised when comparing these results for several reasons. First, alcohol consumption in geographically distant regions may vary due to socio-cultural reasons, including for instance the degree of social acceptance of alcohol consumption, the normative consumption of alcohol in the target population, as well as local, regional and national regulations. In addition, there is a lack of consensus in the literature regarding the concept of binge drinking. Originally defined in 1993 by Wechsler *et al*,³⁸ binge drinking is the practice of consuming five or more drinks for men, and four or more drinks for women, in one episode. Criticism of this conceptualisation of binge drinking has largely been based on substantial variability in blood alcohol concentrations due to differences in consumer weight, duration of the episode and type of beverage consumed.³⁹ Subsequent investigations have used different diagnostic criteria for binge drinking, namely consuming five or more drinks in 2 hours⁴⁰ and

reaching blood alcohol concentrations of 0.08% (0.08 g of alcohol per decilitre).⁴¹ Interestingly, the most widely used screening tool for problematic alcohol use, the AUDIT scale, does not differentiate between the number of drinks consumed on one occasion by men and women. This may be due to the fact that women seem to experience fewer negative effects than men after consuming the same number of drinks in one episode of binge drinking.⁴²

Being ≥ 30 was a protective factor for both risky alcohol consumption and binge drinking in our sample. Previous investigations confirm that the level of alcohol consumption is higher in young college students.⁴³ It is possible that younger students are more permeable than their older peers to several factors favouring alcohol intake, including the social and peer environment.⁴⁴ In addition, a younger age may be associated with a more impulsive, uninhibited personality, as well as a tendency to seek emotions; all personality traits associated with increased substance use.^{45 46} According to McBride *et al*,⁴⁷ alcohol consumption in the college population can be explained and predicted by studying the students' commitment to certain positive expectations, for example, in the fields of sociability and sexuality. In addition, alcohol intake can

Table 3 AUDIT scores and domains by gender

	Total (n=330)		Men (n=145)		Women (n=185)		P value*
	Mean±SD	Median (IQR)	Mean±SD	Median (IQR)	Mean±SD	Median (IQR)	
AUDIT scores							
Total AUDIT	6.39±4.8	5 (2)	7.41±5.2	6.0 (3.0–12.0)	5.59±4.4	4.0 (2.0–9.0)	0.001
Domain 1: Hazardous alcohol use	3.67±2.2	4.0 (2.0–5.0)	4.17±2.3	4.0 (3.0–5.0)	3.27±2.0	3.0 (2.0–5.0)	0.000
Domain 2: Dependence symptoms	0.73±1.1	0.0 (0.0–1.0)	0.88±1.2	0.0 (0.0–2.0)	0.61±1.0	0.0 (0.0–1.0)	0.050
Domain 3: Harmful alcohol use	1.98±2.5	1.0 (0.0–3.0)	2.34±2.7	1.0 (0.0–4.0)	1.70±2.2	1.0 (0.0–2.0)	0.095
Bold values are statistically significant, p<0.05							
*Mann–Whitney U test.							
AUDIT, Alcohol Use Disorders Identification Test.							

Bold values are statistically significant, $p < 0.05$

*Mann–Whitney U test.

AUDIT, Alcohol Use Disorders Identification Test.

Table 4 Logistic regression. Factors related to risky alcohol consumption and binge drinking

	Risky alcohol consumption (AUDIT $\geq$ 8 in men and $\geq$ 6 in women)			Regular binge drinking (monthly or more)		
	OR	95% CI		OR	95% CI	
		Low	Upper		Low	Upper
Age (ref. 18–21 years)						
22–29 years	0.91	0.50	1.67	0.58	0.29	1.16
$\geq$ 30 years	0.22	0.08	0.60	0.28	0.10	0.86
Gender (ref. male)						
Female	0.96	0.54	1.70	0.50	0.27	0.94
Studies (ref. health sciences)						
Others	1.36	0.80	2.31	1.84	0.99	3.40
Residence (ref. family home)						
Away from family home	1.52	0.92	2.54	2.78	1.56	4.95
Employment (ref. no)						
Yes	1.26	0.69	2.29	0.76	0.38	1.50
Smoking (ref. no)						
Yes	3.54	2.03	6.14	3.53	1.94	6.40
Internet use (ref. normal use)						
PIU (IAT score $\geq$ 50)	2.10	1.24	3.53	2.19	1.23	3.89
Physical activity (ref. moderate)						
Low	1.37	0.73	2.56	1.10	0.55	2.22
High	1.21	0.61	2.39	1.08	0.51	2.28
Diet quality (ref. healthy diet)						
Unhealthy diet (SHEI score $\leq$ 80)	1.76	0.84	3.71	2.34	0.92	5.98
X ² (fd)	51.28 (11)			55.66 (11)		
Nagelkerke R ²	0.20			0.23		
P value (model)	0.000			0.000		

Bold values are statistically significant, $p < 0.05$

AUDIT, Alcohol Use Disorders Identification Test; IAT, Internet Addiction Test; PIU, problematic internet users; SHEI, Spanish Healthy Eating Index.

also be used as a (maladaptive) coping strategy to alleviate problems and worries.^{48 49} Therefore, it seems plausible that younger students have fewer effective coping mechanisms in stressful situations than their older colleagues and may, therefore, resort to alcohol to a greater extent.

Living away from the family home was associated with an increased risk of binge drinking. Previous studies have confirmed this association, and have added that binge drinking behaviours increase when students reside on campus.⁶ Several factors may explain these observations. First, moving away from home effectively decreases parental participation and control. Also, as parental influence on young students decreases, peer influence increases. Parental influence on young adults has been described as a protective factor for the acquisition of toxic habits,⁵⁰ including alcohol consumption.⁵¹ Yet, during the transition to college, parents can still influence students' behaviour both directly, through communication, and

indirectly, by shaping their values and helping them select other students as friends.⁵²

Traditionally, being male has been associated with higher alcohol intake in college.^{53 54} In the present sample, gender differences were observed solely in relation to the prevalence of acute heavy drinking. Our findings show that women had half the predisposition than men to partake in binge drinking episodes. However, previous studies have reported that alcohol consumption in young male and female adults seems to be equalising in the Spanish context. A recent study on a sample of Spanish adolescents showed that, up to the age of 16, there are no differences in alcohol consumption patterns between girls and boys.⁵⁵ Future research should analyse the factors associated with this alcohol-related, gender equalisation process.

Both alcohol intake and binge drinking were associated with two negative habits, namely smoking and PIU.

The relationship between alcohol drinking and smoking has previously been reported in the literature⁵⁶ and may be explained by several reasons. First, both alcohol and tobacco can cause physical dependence. Also, both alcohol and smoking frequently serve as 'social lubricants' in social situations.^{57 58} Finally, both substances are sometimes used as a means to escape from negative emotions or problems.^{59 60} Similarly, other authors have found a significant association between PIU and alcohol.⁶¹ According to Lannoy *et al*,⁶² using substances such as alcohol is frequently associated with emotion-seeking, risk-taking and experimentation in young people; these motivations are also associated with certain online activities, such as gambling, gaming and some forms of social and intimate interaction.^{63 64} In addition, from a neurophysiological point of view, both internet activity and stimuli associated with (pathological) gambling and alcohol intake seem to alter neural networks, activating brain regions involved in the processing of rewards and motivations, and altering dopamine metabolism.^{65–67}

There are limitations to this investigation. While the cross-sectional design allows for the establishment of associations, it is not possible to establish causal relationships between the study variables. Longitudinal studies could provide a better basis to understand how alcohol consumption evolves throughout college years, as well as the direction of the association between the study variables, including health-related behaviours. Additionally, it was difficult to compare our findings in relation to binge drinking with those of previous investigations, due to the variability in the categorisation of binge drinking. We made the decision of using the most frequently accepted criterion in our context, that is, ≥ 6 drinks in men and ≥ 5 drinks in women.⁶⁸ Also, all the college students were recruited from USJ, which may limit the representativeness of our findings. However, it should be noted that the gender and age characteristics of the participants are representative of the student profile of USJ and comparable to other Spanish university populations previously reported in the literature.

We believe that our results may be useful to inform future initiatives to promote responsible alcohol consumption in the university context. These may include behavioural interventions, individualised feedback, moderation strategies, management of expectations, goal setting and identification of risk situations.⁶⁹ Further, normative re-education and social norms marketing may be effective to regulate college students' perception of normative drinking behaviour.⁷⁰ Having said this, university-based interventions may be insufficient to tackle the problem at hand as not all young people access university, and it is likely that many students acquire problematic health behaviours, including risky alcohol intake, before entering college. Therefore, we suggest that interventions to reduce the harmful use of alcohol, as well as associated social and health problems, in young adults are planned and implemented collaboratively with other sectors of the community, including

other education institutions, civil society, primary care and public health.

Conclusion

Our results show a high prevalence of risky alcohol consumption in Spanish university students of both genders. Younger age, living away from home, smoking and PIU were factors associated with risky alcohol consumption and binge drinking. Future interventions aimed at reducing the harmful use of alcohol in this population should be based on multicomponent, cooperative and comprehensive approaches between the university and the community.

Contributors ER-A: Conceptualisation, methodology, writing—original draft. IA-S: Conceptualisation, methodology, writing—review and editing. IRB-O: Investigation, writing—review and editing. PG-T: Investigation, writing—review and editing. EB-R: Formal analysis, writing—review and editing. LG-M: Supervision, writing—review and editing. ER-A is the guarantor.

Funding This work was financed by the Government of Aragón (Spain). Research Reference Team SAPIENF B53_23R (University of Zaragoza).

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Consent obtained directly from patient(s).

Ethics approval This study involves human participants and was approved by Comité de Ética de la Investigación de la Comunidad Autónoma de Aragón: CEICA, Reference number: C.P. - C.I. PI20/93. Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request. The anonymised database is available upon reasonable request from the first author.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

ORCID iDs

Isabel Antón-Solanas <http://orcid.org/0000-0002-8206-4803>

Piedad Gómez-Torres <http://orcid.org/0000-0003-0045-7871>

REFERENCES

- World Health Organization. Alcohol Alcohol. 2022. Available: <https://www.who.int/news-room/fact-sheets/detail/alcohol>
- GBD 2017 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet* 2017;392:1789–858.
- World Health Organisation. Alcohol policy implementation in the European Region: a 2015 update. 2017.
- Rekve D, Banatvala N, Karpai A, *et al*. Prioritising action on alcohol for health and development. *BMJ* 2019;367:l6162.
- Soler-Vila H, Galán I, Valencia-Martín JL, *et al*. Binge drinking in Spain, 2008–2010. *Alcohol Clin Exp Res* 2014;38:810–9.
- Merrill JE, Carey KB. Drinking Over the Lifespan: Focus on College Ages. *Alcohol Res* 2016;38:103–14.
- Hutchesson MJ, Whatnall MC, Yazini N, *et al*. Health behavior interventions for university students measuring mental health outcomes: A scoping review. *Front Public Health* 2022;10:1063429.
- Riordan BC, Carey KB. Wonderland and the rabbit hole: A commentary on university students' alcohol use during first year and the early transition to university. *Drug Alcohol Rev* 2019;38:34–41.

- 9 Ibáñez MI, Camacho L, Mezquita L, *et al.* Alcohol Expectancies Mediate and Moderate the Associations between Big Five Personality Traits and Adolescent Alcohol Consumption and Alcohol-Related Problems. *Front Psychol* 2015;6:1838.
- 10 Amare T, Getinet W. Alcohol use and associated factors among high school, college and university students in Ethiopia, systematic review, and meta-analysis, 2018. *J Ment Health* 2020;29:455–63.
- 11 Cooke ME, Neale ZE, Barr PB, *et al.* The Role of Social, Familial, and Individual-Level Factors on Multiple Alcohol Use Outcomes During the First Year of University. *Alcohol Clin Exp Res* 2017;41:1783–93.
- 12 Teixidó-Compañó E, Sureda X, Bosque-Prous M, *et al.* Understanding how alcohol environment influences youth drinking: A concept mapping study among university students. *Adicciones* 2023;35:469–82.
- 13 Martinetti MP, Caughron RL, Berman HL, *et al.* The Behavioral Economics of Alcohol Demand in French and American University Students. *Alcohol Clin Exp Res* 2019;43:531–44.
- 14 Fuller A, Fleming KM, Szatkowski L, *et al.* Nature of events and alcohol-related content in marketing materials at a university freshers' fair: a summative content analysis. *J Public Health (Oxf)* 2018;40:e320–7.
- 15 Forsström D, Rozental A, Sundqvist K. Alcohol Use and Gambling Associated with Impulsivity among a Swedish University Sample. *Int J Environ Res Public Health* 2022;19:2436.
- 16 López-Moreno M, Garcés-Rimón M, Miguel M, *et al.* Influence of eating habits and alcohol consumption on the academic performance among a university population in the community of Madrid: A pilot study. *Heliyon* 2021;7:e07186.
- 17 Htet H, Saw YM, Saw TN, *et al.* Prevalence of alcohol consumption and its risk factors among university students: A cross-sectional study across six universities in Myanmar. *PLoS One* 2020;15:e0229329.
- 18 Moure-Rodríguez L, Carbia C, Lopez-Caneda E, *et al.* Trends in alcohol use among young people according to the pattern of consumption on starting university: A 9-year follow-up study. *PLoS One* 2018;13:e0193741.
- 19 Lui PP, Berkley SR, Zamboanga BL. College alcohol belief and alcohol use: Testing moderations by cultural orientations and ethnicity. *J Couns Psychol* 2020;67:184–94.
- 20 Alley ZM, Kerr DCR, Bae H. Trends in college students' alcohol, nicotine, prescription opioid and other drug use after recreational marijuana legalization: 2008–2018. *Addict Behav* 2020;102:S0306-4603(19)30783-X.
- 21 Rodríguez Muñoz PM, Carmona Torres JM, Hidalgo Lopezosa P, *et al.* Evolution of alcohol and tobacco consumption in young people in Spain, after the law 42/2010 against smoking: 2011–2014. *Adicciones* 2019;31:274–83.
- 22 Fernández-Villa T, Molina AJ, García-Martín M, *et al.* Validation and psychometric analysis of the Internet Addiction Test in Spanish among college students. *BMC Public Health* 2015;15:953.
- 23 Young KS. The research and controversy surrounding internet addiction. *Cyberpsychol Behav* 1999;2:381–3.
- 24 Younes F, Halawi G, Jabbour H, *et al.* Internet Addiction and Relationships with Insomnia, Anxiety, Depression, Stress and Self-Esteem in University Students: A Cross-Sectional Designed Study. *PLoS One* 2016;11:e0161126.
- 25 Scoring protocol for the International Physical Activity Questionnaire (IPAQ). Score the IPAQ, 2022. Available: <https://sites.google.com/view/ipaq/score>
- 26 Rodríguez-Muñoz S, Corella C, Abarca-Sos A, *et al.* Validation of three short physical activity questionnaires with accelerometers among university students in Spain. *J Sports Med Phys Fitness* 2017;57:1660–8.
- 27 Norte Navarro AI, Ortiz Moncada R. Spanish diet quality according to the healthy eating index. *Nutr Hosp* 2011;26:330–6.
- 28 Kennedy ET, Ohls J, Carlson S, *et al.* The Healthy Eating Index: design and applications. *J Am Diet Assoc* 1995;95:1103–8.
- 29 Hann CS, Rock CL, King I, *et al.* Validation of the Healthy Eating Index with use of plasma biomarkers in a clinical sample of women. *Am J Clin Nutr* 2001;74:479–86.
- 30 Babor TF, Higgins-Biddle JC, Saunders JB, *et al.* AUDIT: the alcohol use disorders identification test: guidelines for use in primary health care. 2001.
- 31 García Carretero MÁ, Novalbos Ruiz JP, Martínez Delgado JM, *et al.* Validation of the Alcohol Use Disorders Identification Test in university students: AUDIT and AUDIT-C. *Adicciones* 2016;28:194–204.
- 32 Ballester L, Alayo I, Vilagut G, *et al.* Validation of an Online Version of the Alcohol Use Disorders Identification Test (AUDIT) for Alcohol Screening in Spanish University Students. *Int J Environ Res Public Health* 2021;18:5213.
- 33 Cooke R, Beccaria F, Demant J, *et al.* Patterns of alcohol consumption and alcohol-related harm among European university students. *Eur J Public Health* 2019;29:1125–9.
- 34 Heradstveit O, Skogen JC, Brunborg GS, *et al.* Alcohol-related problems among college and university students in Norway: extent of the problem. *Scand J Public Health* 2021;49:402–10.
- 35 Heradstveit O, Sivertsen B, Lønning K-J, *et al.* The Extent of Alcohol-Related Problems Among College and University Students in Norway Prior to and During the COVID-19 Pandemic. *Front Public Health* 2022;10:876841.
- 36 Tavoracci M-P, Boerg E, Richard L, *et al.* Prevalence of binge drinking and associated behaviours among 3286 college students in France. *BMC Public Health* 2016;16:178.
- 37 Herrero-Montes M, Alonso-Blanco C, Paz-Zulueta M, *et al.* Excessive alcohol consumption and binge drinking in college students. *PeerJ* 2022;10:e13368.
- 38 Wechsler H, Davenport A, Dowdall G, *et al.* Health and behavioral consequences of binge drinking in college. A national survey of students at 140 campuses. *JAMA* 1994;272:1672–7.
- 39 Perkins HW, Linkenbach J, Dejong W. Estimated blood alcohol levels reached by “binge” and “nonbinge” drinkers: a survey of young adults in Montana. *Psychol Addict Behav* 2001;15:317–20.
- 40 National Institute on Alcohol Abuse and Alcoholism. NIAAA council approves definition of binge drinking. NIAAA Newsletter. 2004;3.
- 41 Dimeff LA, Kilmer J, Baer JS, *et al.* Binge drinking in college. *JAMA* 1995;273:1903–4.
- 42 Kuntsche E, Kuntsche S, Thrul J, *et al.* Binge drinking: Health impact, prevalence, correlates and interventions. *Psychol Health* 2017;32:976–1017.
- 43 Berger AL, Wang A, Martusewicz ZJ, *et al.* Defining Belonging and Its Association to Binge Drinking among College Students. *Subst Use Misuse* 2022;57:1341–4.
- 44 Van Damme J, Hublet A, De Clercq B, *et al.* Context matters: Student-perceived binge drinking norms at faculty-level relate to binge drinking behavior in higher education. *Addict Behav* 2016;59:89–94.
- 45 Fisher S, Hsu W-W, Adams Z, *et al.* The effect of impulsivity and drinking motives on alcohol outcomes in college students: a 3-year longitudinal analysis. *J Am Coll Health* 2022;70:1624–33.
- 46 O'Leary DS, Langbehn DR, Kramer JR, *et al.* Personality traits and negative consequences associated with binge drinking and marijuana use in college students. *Am J Drug Alcohol Abuse* 2019;45:400–9.
- 47 McBride NM, Barrett B, Moore KA, *et al.* The role of positive alcohol expectancies in underage binge drinking among college students. *J Am Coll Health* 2014;62:370–9.
- 48 Cook MA, Newins AR, Dvorak RD. Coping Motivated Alcohol Use: The Role of Social Anxiety and Dissociation. *Subst Use Misuse* 2021;56:275–85.
- 49 Lucke HR, Carey CN, Griffith EL, *et al.* Self-control, coping styles, and alcohol outcomes in college students. *J Am Coll Health* 2024;72:3376–83.
- 50 Kvillemo P, Hiltunen L, Demetry Y, *et al.* How to prevent alcohol and illicit drug use among students in affluent areas: a qualitative study on motivation and attitudes towards prevention. *Subst Abuse Treat Prev Policy* 2021;16:83.
- 51 Pistella J, Isolani S, Morelli M, *et al.* Helicopter parenting and alcohol use in adolescence: A quadratic relation. *Nordisk Alkohol Nark* 2022;39:134–45.
- 52 Rulison KL, Wahesh E, Wyrick DL, *et al.* Parental Influence on Drinking Behaviors at the Transition to College: The Mediating Role of Perceived Friends' Approval of High-Risk Drinking. *J Stud Alcohol Drugs* 2016;77:638–48.
- 53 Benjet C, Mortier P, Kiekens G, *et al.* A risk algorithm that predicts alcohol use disorders among college students. *Eur Child Adolesc Psychiatry* 2022;31:1–11.
- 54 Niedermeier M, Frühauf A, Kopp-Wilfling P, *et al.* Alcohol Consumption and Physical Activity in Austrian College Students-A Cross-Sectional Study. *Subst Use Misuse* 2018;53:1581–90.
- 55 Leal-López E, Sánchez-Queija I, Rivera F, *et al.* Trends in alcohol consumption among school-aged adolescents in Spain (2010–2018). *Gac Sanit* 2021;35:35–41.
- 56 Nășui BA, Ungur RA, Talaba P, *et al.* Is Alcohol Consumption Related to Lifestyle Factors in Romanian University Students? *Int J Environ Res Public Health* 2021;18:1835.
- 57 Goodman FR, Stikma MC, Kashdan TB. Social Anxiety and the Quality of Everyday Social Interactions: The Moderating Influence of Alcohol Consumption. *Behav Ther* 2018;49:373–87.
- 58 Yang XY. Class Status and Social Mobility on Tobacco Smoking in Post-Reform China Between 1991 and 2011. *Nicotine Tob Res* 2020;22:2188–95.

- 59 Crum RM, Green KM, Amin-Esmaili M, *et al.* The role of mood disorders in the progression of and recovery from alcohol and drug use problems: A latent transition analysis. *Drug Alcohol Depend* 2022;238:S0376-8716(22)00303-9.
- 60 Torres OV, Estep JC, Gwin M, *et al.* Gender Differences in Negative Mood, Emotional Intelligence and Tobacco Use among Young Adults. *Subst Use Misuse* 2020;55:1881–91.
- 61 Wang J, Hao Q, Tu Y, *et al.* Assessing the Association Between Internet Addiction Disorder and Health Risk Behaviors Among Adolescents and Young Adults: A Systematic Review and Meta-Analysis. *Front Public Health* 2022;10:809232.
- 62 Lannoy S, Mange J, Leconte P, *et al.* Distinct psychological profiles among college students with substance use: A cluster analytic approach. *Addict Behav* 2020;109:S0306-4603(20)30607-9.
- 63 Mallorquí-Bagué N, Fernández-Aranda F, Lozano-Madrid M, *et al.* Internet gaming disorder and online gambling disorder: Clinical and personality correlates. *J Behav Addict* 2017;6:669–77.
- 64 Torres-Rodríguez A, Griffiths MD, Carbonell X, *et al.* Internet gaming disorder in adolescence: Psychological characteristics of a clinical sample. *J Behav Addict* 2018;7:707–18.
- 65 Baik J-H. Dopamine signaling in reward-related behaviors. *Front Neural Circuits* 2013;7:152.
- 66 Ko C-H, Liu G-C, Hsiao S, *et al.* Brain activities associated with gaming urge of online gaming addiction. *J Psychiatr Res* 2009;43:739–47.
- 67 Zakariaei Y, Scheinost D, Seo D, *et al.* Cingulate cortex functional connectivity predicts future relapse in alcohol dependent individuals. *Neuroimage Clin* 2017;13:181–7.
- 68 Valencia Martín JL, Galán I, Segura García L, *et al.* Binge drinking: the challenges of definition and its impact on health. *Rev Esp Salud Publica* 2020;94:e202011170.
- 69 Scott-Sheldon LAJ, Carey KB, Elliott JC, *et al.* Efficacy of alcohol interventions for first-year college students: A meta-analytic review of randomized controlled trials. *J Consult Clin Psychol* 2014;82:177–88.
- 70 Foxcroft DR, Moreira MT, Almeida Santimano NML, *et al.* Social norms information for alcohol misuse in university and college students. *Cochrane Database Syst Rev* 2015;1:CD006748.