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Spanish Adaptation of the Protective Behavioral Strategies Scale-20 (S-PBSS-20) and Evaluation of its Psychometric Properties in University Students

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Abstract

Background: Protective behavioral strategies (PBS) have shown utility in reducing alcohol-related negative consequences. The Protective Behavioral Strategies Scale (PBSS) is one of the most widely used and well-validated instruments for evaluating these strategies. However, a Spanish adaptation of this or any other measure of PBS is not available. We aimed to provide a Spanish version of PBSS-20 and examine its psychometric properties. **Method:** We recruited 538 undergraduate students from three Spanish universities (mean age = 21.2; females = 78%). Measures included the Spanish-PBSS-20 (S-PBSS-20), Young Adult Alcohol Consequences Questionnaire (YAACQ), Daily Drinking Questionnaire, and frequency of alcohol use, drunkenness, and binge drinking. **Results:** Our results support the use of the original 3-factor structure of the PBSS-20. Internal consistency reliability ranged between 0.71-0.77, and evidence of validity was provided according to the expected relationships with other variables. Exploratory factor analyses provided evidence of convergent/discriminant validity of S-PBSS-20. **Conclusions:** The results suggest that PBSS-20 is a useful instrument for assessing protective behavioral strategies in alcohol users. The S-PBSS-20 could be useful for research on alcohol-related protective behavioral strategies and consequences, and could also inform the design of educational interventions for promoting the use of protective strategies and reducing alcohol-related negative consequences.

Keywords: Alcohol; protective behavioral strategies scale; psychometric properties; Spanish adaptation.

Resumen

Adaptación Española de la Escala de Estrategias Conductuales de Protección-20 (S-PBSS-20) y Evaluación de sus Propiedades Psicométricas en Estudiantes Universitarios. **Antecedentes:** las estrategias conductuales de protección (ECP) han mostrado utilidad para reducir las consecuencias negativas del alcohol. La Escala de Estrategias Conductuales de Protección (PBSS) es uno de los instrumentos más utilizados y validados para evaluar estas estrategias. Sin embargo, no contamos con una adaptación española de este u otro instrumento para medir ECP. Objetivo: aportar una versión española de la PBSS-20 y analizar sus propiedades psicométricas. **Método:** participaron 538 estudiantes de tres universidades españolas (edad media = 21,2; mujeres = 78%), administrándose el Cuestionario de Consecuencias del Consumo de Alcohol en Jóvenes Adultos (YAACQ) y el Cuestionario de Consumo Diario de alcohol. Se recogió información sobre frecuencia de consumo, borracheras y atracón. **Resultados:** los resultados apoyan el uso de la PBSS-20 original con una estructura de tres factores. La fiabilidad como consistencia interna osciló entre 0.71-0.77 y se aportaron evidencias de validez según las relaciones teóricas esperadas. El análisis factorial exploratorio aportó evidencias de validez convergente/discriminante. **Conclusiones:** los resultados apoyan la utilidad de la PBSS-20 para medir ECP en consumidores de alcohol. La S-PBSS-20 puede ser útil tanto para la investigación sobre ECP, como para orientar intervenciones educativas de promoción de estas estrategias y de reducción de consecuencias negativas asociadas al alcohol.

Palabras clave: alcohol; escala de estrategias conductuales de protección; propiedades psicométricas; adaptación española.

Alcohol consumption is a major risk factor for health problems, being linked to disability, disease, and death (World Health Organization -WHO-, 2018). It is estimated that 5.3% of deaths worldwide can be attributed to alcohol, and this rises to 13.9% in the 20-39-year age group (WHO, 2018). Alcohol consumption is associated with many harmful and risky behaviors, including unsafe sex (Chaney et al., 2016), violent behavior (Duke et al., 2018), and sexual assault (Lorenz & Ullman, 2016). Moreover, binge drinking could increase the likelihood of experiencing acute negative consequences (Kuntsche et al., 2017).

To minimize the potential harm associated with drinking, many people use protective behavioral strategies (PBS), defined as "specific cognitive-behavioral strategies that can be used by an individual to help reduce his or her alcohol use and the negative consequences resulting from such use" (Martens et al., 2007, p. 308). Alcohol-related protective strategies have also been operationalized in other ways, including self-control strategies (Werch & Gorman,

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1986) or drinking control strategies (Sugarman & Carey, 2007). Within the definition of these strategies, the following two approaches can be identified (Pearson, 2013): narrow definitions, which include strategies used immediately prior to, during, or after drinking; and broad definitions, which, in addition, include strategies related to avoiding alcohol completely. An example of a narrow definition is the one established by Martens et al. (2005), who define PBS as strategies used during or immediately prior to drinking. An advantage of PBS in comparison with some personal protective characteristics (e.g., gender) associated with decreased alcohol consumption is that PBS (e.g., drinking water whilst drinking alcohol) can be taught and are therefore easy to change through intervention (Martens et al., 2005).

Numerous studies indicate that PBS use is related to a less intensive pattern of drinking and the experience of fewer alcohol-related negative consequences (e.g., García et al., 2018; Martens et al., 2007; Pearson, 2013). Longitudinal studies have also revealed this relationship, suggesting the predictive capacity of PBS use for drinking patterns and their associated consequences (Grazioli et al., 2015; Martens et al., 2011). Moreover, several studies have shown how interventions aimed at promoting the use of these strategies are effective in reducing alcohol-related harm (Dvorak et al., 2015).

These advances in the field of research on alcohol use are linked to, among other factors, the development of standardized procedures for collecting data on PBS use. Numerous measurement scales have been designed, including the Self-Control Questionnaire (SCQ, Werch & Gorman, 1986), the National College Health Assessment-NCHA (Delva et al., 2004), the Strategy Questionnaire-SQ (Sugarman & Carey, 2007) and the Protective Behavioral Strategies Scale-PBSS (Martens et al., 2005). The latter is the most widely used scale for measuring PBS (Pearson, 2013; Prince et al., 2013) and has shown more adequate psychometric functioning in comparison with other similar scales (Pearson, 2013).

The original version (Martens et al., 2005) of the PBSS was developed to measure the use of PBS in university students. In terms of operational definition (Muñiz & Fonseca-Pedrero, 2019), for PBSS development, these authors conducted a literature review on college student drinking, which generated an initial pool of items that were then reviewed by six graduate students with a background in analysis of alcohol use in college students. This resulted in a 25-item version which, after undergoing various analytical procedures (including exploratory factor analysis), resulted in the final version of 15 items grouped into three dimensions: stopping/limiting drinking (SLD-seven items), which include strategies related to stopping or slowing down alcohol consumption (e.g., stop drinking at a predetermined time); mode of drinking (MOD-five items), strategies focused on the different ways in which alcohol may be consumed (e.g., avoid drinking games); and serious harm reduction (SHR-three items), defined as strategies that are used to avoid potential and dangerous alcohol consequences (e.g., use a designated driver). Various studies suggest the adequate psychometric functioning of the SLD and MOD dimensions (García et al., 2018; Pearson, 2013). In contrast, the scores of the SHR dimension has shown reliability and validity problems, which have been attributed to its low number of items (Martens et al., 2005; 2007).

These results led Martens and colleagues to develop an extended version of the PBSS that incorporates five items into this dimension (PBSS-20, Treloar et al., 2015). The study conducted with this 20-item scale revealed a three-factor structure, demonstrating that the factorial loadings of the items were consistent with the proposed theoretical structure. Reliability of the scale scores (estimated by test-retest) varied between r=0.59 (SLD) and r=0.67 (SHR). For the original scale, Martens et al. (2005) estimated the internal consistency for SHR (three items), reporting a Cronbach's alpha value of 0.63, whilst Treloar et al. (2015) reported a value of 0.71 for the original SHR scale scores (three items) and 0.86 for the new SHR scale (eight items). Moreover, the PBSS-20 SHR scale also showed greater evidence of validity in terms of alcohol-related negative consequences, both concurrently and prospectively.

Some studies have provided support for an internal structure that differs from that proposed in the original PBSS, both for PBSS-15 (Martens et al., 2005) and PBSS-20 (Treloar et al., 2015). In relation to the PBSS-15, Walters et al. (2007), with a sample of university students, found support for a four-factor internal structure in which the SLD scale was divided into two factors: SLD-mixing and SLD-planning limits on drinking. In contrast, Madson et al. (2013) found support for a two-factor internal structure of the PBSS-15 with a sample of college students. In this version, the MOD and SLD dimensions were grouped into a single dimension termed Controlled consumption.

With regard to PBSS-20, Richards et al. (2018) studied two internet samples of adult drinkers, identifying a three-factor structure of the PBSS-20. However, given that six items were eliminated and two items of the SHR scale showed a higher factor loading in the MOD scale, their results do not support the proposed factor structure. Grazioli et al. (2019), in a sample of young males, found support for the four-factor structure proposed by Walters et al. (2007) for the German and French versions of the PBSS-20. This evidence of validity of the PBSS casts doubts on an interpretation of the scores in terms of the domains it aims to assess (SHR, MOD and SLD), and, in turn, this also affects interpretations of the relationships with other variables. Therefore, it is necessary to provide new evidence on the psychometric functioning of the PBSS-20. Further, despite the increasingly widespread use of the PBSS at an international level, there is currently no available Spanish adaptation of this instrument or any other scale designed to assess PBS. This hinders both research and the development of preventive and clinical programs among the Spanish-speaking community.

Since the development of the PBSS-20 in 2015, many authors have continued to use the 15-item version (e.g., García et al., 2018; Grazioli et al., 2018), although the work of Treloar et al. (2015) showed that, in terms of content validity and reliability, the 20-item version is superior. Therefore, we aimed to develop an adapted Spanish version of the PBSS-20 (Treloar et al., 2015), and to study its psychometric properties.

Previous research has yielded support for an internal structure of two (Madson et al., 2013), three (Martens et al., 2005; Treloar et al., 2015) and four dimensions (Richards et al., 2018; Walters et al., 2007) of the PBSS. Further, numerous investigations have interpreted the total PBSS score, showing evidence of its negative relationship with alcohol consumption and its associated negative consequences, both in cross-sectional (e.g., Terlecki et al., 2020) and longitudinal studies (e.g., Grazioli et al., 2015). However, to our knowledge, the interpretability of the total PBSS score has not yet been tested. Thus, taking into account previous evidence, our aim was to test the model structures with two, three and four dimensions. We also tested two different structures

that could support the interpretability of the PBSS total score: a unidimensional structure and one with 3-first order factors (SHR, MOD and SLD) with a second order factor (total PBSS).

To achieve our aims, we conducted an item analysis and reliability estimation of the scale scores in our sample. As evidence of validity, we conducted confirmatory factor analysis to test different factor models of PBSS, and we used exploratory factor analysis to provide evidence of convergent and discriminant validity. To provide evidence of validity based on the relationship with other variables, we analyzed the PBSS scores with respect to alcohol consumption patterns and alcohol-related negative consequences.

Methods

Participants

Our study sample comprised 603 undergraduate students recruited by convenience sampling from three Spanish universities in the South of Spain (universities of Almeria, Huelva and Seville). The inclusion criterion was to have consumed alcohol at least once in the last three months. The data of 65 subjects were discarded due to: having never consumed alcohol (n=49), reporting no alcohol consumption in the last three months (n=14), and failing to report the frequency of alcohol consumption (n=2). Thus, the final sample consisted of 538 university students (University of Huelva, 59.3%; University of Almería, 24.5%; and University of Seville, 16.2%) who were studying the degree in Psychology (66.9%) Social Education (20.1%) or Education (13.0%). The mean age of the participants was 21.21 years (*SD*= 3.62), and 78.0% were women.

Of the sample, 20.6% reported drinking less than once a month during the past three months, 38.8% between one-three times a month, 20.4% once a week, and 20.0% two or more times a week.

Instruments

Alcohol consumption. We collected information on how often participants had engaged in the following behaviors in the past three months: drinking alcohol, getting drunk, and binge drinking, the latter defined as "consuming five or more drinks (in men) or four or more drinks (in women) within a two-hour interval" (Courtney & Polich, 2009). For these three measures, the response options were: never/less than once a month/1-3 times a month/ once a week/2-3 times a week/4-6 times a week/daily.

Quantity of alcohol consumed: A modified version of the Daily Drinking Questionnaire (DDQ-Collins et al., 1985), was administered to measure the amount of alcohol consumed in a typical week in the last month. This questionnaire asks about the consumption of six types of alcoholic beverages, with each question accompanied by images of the beverages, as established by the Spanish Observatory of Drugs and Addictions (Observatorio Español de las Drogas y las Adicciones, 2019). This number was then converted into Standard Drink Units (SDUs). In Spain, each SDU is equivalent to 10 grams of pure alcohol (Rodríguez-Martos et al., 1999).

Spanish Version of the Protective Behavioral Strategies Scale-20 (Spanish PBSS-20; S-PBSS-20). We adapted the PBSS-20 developed by Treloar et al. (2015), which is composed of three dimensions: stopping/limiting drinking (SLD-seven items), mode of drinking (MOD-five items) and serious harm reduction (SHR-eight items). A Likert response format was used with five response options coded between 1-5 (never-always).

Negative consequences experienced in the last three months. We used the Spanish version of the Young Adult Alcohol Consequences Questionnaire (YAACQ, Read et al., 2006). However, the items used here had been adapted to the Spanish culture (Bravo et al., 2018). This scale consists of 48 dichotomous items (presence/absence) measuring eight dimensions. Following the recommendations of the authors of the original scale and the Spanish version, we used tetrachoric correlations to estimate the internal consistency, finding Cronbach's Alpha values between α=0.72-0.87 (0.96 for the overall score).

Procedure

The PBSS-20 was adapted (Treloar et al., 2015) in accordance with the International Test Commission (2017) for the adaptation of tests between cultures. Initially, we explored the equivalence between the U.S and Spanish cultures regarding the construct underlying the PBSS and its dimensions (considering linguistic, psychological, and cultural differences). As a result, we concluded that both the PBSS construct and its dimensions could be extrapolated to the Spanish culture.

The translation and adaptation process then began with three members of the research team independently adapting the PBSS-20 items. In this preliminary version, all three members agreed on the wording of 10 items, two agreed on seven items, whilst there was a discrepancy between the members on three items. Later, each team member received a document containing the items that differed from the English version and the written proposals of the other two members. Each researcher independently submitted a draft for each item considering the translations provided by the other two researchers. Subsequently, the team discussed these discrepant items (n=2) until reaching a consensus. This version was then sent to a professional American translator (PhD in Psychology) for back-translation. The back-translated version showed agreement —except for minor discrepancies— on 17 of the 20 PBSS items. The team and the translator discussed the three discrepant items until a final version was produced for submission to the empirical psychometric study. Due to cultural differences, in the final version of the S-PBSS-20, the wording of items 1, 17 and 18 was slightly modified (see Table 1).

Once the study protocol had been approved by the bioethics committee of the University of Almería (Spain), the three universities were contacted. Individuals who agreed to participate provided written informed consent and completed the self-administered questionnaire in groups of 20-50. Confidentiality and anonymity were guaranteed, and the students completed the questionnaire in their classrooms, in the presence of an interviewer.

Data analysis

Descriptive analyses (means, standard deviations, asymmetry and kurtosis) were conducted for S-PBSS-20 items, and tests were also carried out for the presence of floor, ceiling and bimodality effects. Item-subscale correlation coefficients are also provided as evidence of item adequacy. To test the normal distribution of the data, the Kolmogorov-Smirnov test was used. Moreover, we carried out an analysis of the differential items functioning (DIF) across gender using the 'lordif' R package (Choi et al., 2011).

Various authors (e.g., Zumbo et al., 2007) argue that, assuming an ordinal level of measurement, alpha is the least biased indicator of the consistency of Likert-type items. Thus, internal consistency was estimated using Ordinal Alpha. These analyses were conducted with the "userfriendlyscience" R package (Peters, 2018).

To study the internal structure of the test, confirmatory factor analysis (*CFA*) was applied using the EQS 6.1 software (robust parameter estimation method, ML-Robust), testing five factor structures. To determine the model fit, in addition to Satorra-Bentler scaled χ^2 (*SB* χ^2, Satorra & Bentler, 2001), we employed the following fit indices that are least affected by sample size: goodness of fit index (*GFI*), comparative fix index (*CFI*), non-normed fit index (*NNFI*), root mean square error of approximation (*RMSEA*) and Aikake information criteria (*AIC*). *GFI, CFI* and *NNFI* values close to .90 or .95 are taken to indicate a good fit; *RMSEA* < .05 indicates good fit and values between 0.05-0.08 indicate an acceptable fit; *AIC* compare alternative models and lower values indicate a better fit (Ferrando & Anguiano-Carrasco, 2010; Schumacker & Lomax, 2010).

An exploratory factor analysis was conducted (using principal axis factoring with oblique rotation) to provide evidence of

Table 1
Item Means, Standard Deviations, percentage according to item response options, and item-total correlation for S-PBSS-20 subscales

			Response options					
SHR subscale: Items	***M***	***SD***	**1**	**2**	**3**	**4**	**5**	**Item-total correlation**
1. Use a designated driver [Elegir a alguien que no beberá para poder conducir]	3.83	1.45	13.7	7	11.5	18.4	49.4	.55
7. Make sure that you go home with a friend [Asegurarte de volver a casa con un/a amigo/a]	3.78	1.23	7.6	8.4	18.6	29.7	35.7	.52
8. Know where your drink has been at all times [Saber en todo momento dónde está tu bebida]	4.48	0.89	1.7	3.4	6.5	22	66.4	.45
15. Refuse to travel in a car with someone who has been drinking [Negarte a subir en un vehículo que conduce alguien que ha estado bebiendo]	4.00	1.15	4.1	8	17	25.7	45.1	.57
16. Only go out with people you know and trust [Salir sólo con gente que conoces y en la que confías]	4.17	0.936	1.7	3.7	15.4	34	45.2	.54
17. Avoid combining alcohol with marijuana [Evitar mezclar alcohol con porros (hachís, marihuana)]	4.23	1.27	8.1	4.9	8.6	13.1	65.4	.52
19. Make sure you drink with people who can take care of you if you drink too much [Asegurarte de beber con gente que cuidará de ti si bebes demasiado]	3.90	1.12	4.3	8.2	17.9	32.6	36.9	.63
20. Eat before or during drinking [Comer antes de beber o mientras bebes]	4.21	0.90	1.3	3.4	14.5	34.6	46.2	.48
Sum of scores (8-40)	32.64	4.77						
Mean score (1-5)	4.08	0.60						
			Response options					
MOD subscale: Items	**M**	**SD**	**1**	**2**	**3**	**4**	**5**	**Item-total correlation**
5. Avoid drinking games [Evitar juegos que impliquen beber alcohol]	2.27	1.24	34.7	27.8	20.3	9.9	7.3	.67
12. Avoid mixing different types of alcohol [Evitar la mezcla de diferentes tipos de alcohol]	3.52	1.20	7	14.5	22	32.8	23.7	.69
13. Drink slowly, rather than gulping or chugging [Beber despacio, en lugar de hacerlo rápido o a grandes tragos]	3.35	1.05	4.5	45.2	36.3	29.1	14.8	.74
14. Avoid trying to keep up with or out-drink others [Evitar seguir el mismo ritmo o beber más que los demás]	3.07	1.36	15.2	24.2	19.5	21.2	20	.66
18. Avoid pregaming (i.e. drinking alcohol before going out) [Evitar beber antes de salir]	2.65	1.32	23.2	27.9	23.8	11.2	13.9	.70
Sum of scores (5-25)	14.88	4.27						
Mean score (1-5)	2.98	0.85						
			Response options					
SLD subscale: Items	**M**	**SD**	**1**	**2**	**3**	**4**	**5**	**Item-total correlation**
2. Before drinking, set yourself a maximum limit of the number of drinks you will consume [Determinar un número máximo de bebidas que consumirás]	2.31	1.19	32.1	27.1	22.9	13	4.9	.65
3. Alternate between alcoholic and nonalcoholic drinks [Alternar bebidas con y sin alcohol]	2.29	1.18	33.3	24.7	27.7	8.7	5.6	.63
4. Have a friend who will let you know when you've had enough to drink [Tener un/a amigo/a que te diga cuando has bebido suficiente]	2.41	1.31	33.4	23.1	21.6	13.1	8.8	.54
6. Leave the bar/party at a predetermined time [Marcharte del bar/fiesta a una hora predeterminada]	2.54	1.12	23.1	23.7	33.6	15.6	3.9	.60
9. Stop drinking at a predetermined time [Parar de beber a una hora predeterminada]	2.55	1.16	21.4	29.5	28	15.2	5.8	.66
10. Drink water while drinking alcohol [Beber agua mientras bebes alcohol]	1.70	0.94	56.1	24.2	15.2	3.4	1.3	.56
11. Put extra ice in your drink [Poner hielo extra en tu bebida]	2.74	1.26	20.8	22.1	30	16.5	10.7	.49
Sum of scores (7-35)	16.41	4.85						
Mean score (1-5)	2.34	0.69						

Note: Response options, 1=never, 2=Almost never, 3=sometimes, 4=Almost always, 5=always. SHR=Serious Harm Reduction; SLD=Stopping/Limiting Drinking; MOD=Manner of Drinking

convergent and discriminant validity, including the YAACQ and PBSS-20 subscales. In order to provide evidence of validity based on the relationship with other variables, linear multiple regression analyses with a hierarchical procedure for variables selection were employed to test the explanatory power of the PBSS with respect to five alcohol-related outcomes**.** The linearity assumption was assessed by visually inspecting the residuals vs fitted plots resulting from the regression models tested.

Results

Item analysis

Results of descriptive analyses (means, standard deviations, asymmetry and kurtosis) can be observed in Table 1. No floor/ceiling effects were observed for any of the PBSS-20 items, with the lowest percentage of choice being below 1.3%, whilst none of the response alternatives accounted more than 66% of the response options. No bimodal structure was observed in the items. Nonetheless, the item values of asymmetry and kurtosis and Kolmogorov-Smirnoff test indicate that our items are slightly non-normally distributed.

The items showed medium to high item-total correlation, ranging from .45 (Item 16, SHR) to .74 (Item 13, MOD). Regarding the percentages of choice for each response option, the items of the SLD subscale, which have lower means, account for the highest percentage of the lowest response options ('Never' or 'Almost never'). In contrast, for SHR items, the highest percentages are observed in the higher response options ("Always" or "Almost always"). The items showed no DIF according to gender, except for Item 7 (SHR).

Evidence of validity based on the internal structure and reliability of scale scores

Table 2 displays the results of testing the five structures. CFA did not support either one or two factor structures. In terms of the CFI and NNFI indices, the models three to five should be rejected, but in terms of the GFI, RMSEA and AIC indices could be interpreted as a marginal fit. However, the factor structure in model five presents low reliability coefficients on the SLD-Planning limits scores (α=0.61) and SLD-Mixing scores (α=0.42), thus questioning its use. In the three-factor model, Pearson correlations between factors were: SHR-SLD = .58; SHR-MOD = .54, and SLD-MOD = .74. The item factor loadings ranged from .37 to .61 (SHR), .32 to .63 (SLD), and .54 to .70 (MOD). In model four, the factor loading from PBSS to first-order factors was high (SHR = .65, SLD = .89, and MOD = .83).

Internal consistency analysis revealed adequate values for each of the scales (SHR: ordinal α= 0.71, MOD: ordinal α= 0.77, SLD: ordinal α= 0.75). Since the unidimensional model is not suitable, to estimate the reliability of the full scale (PBSS) we followed the recommendations of Viladrich et al. (2017) and Black et al. (2015) to calculate reliability in a second-order factor model. The reliability of factor-weighted PBSS scores was .71.

Evidence of validity based on the relationship with other variables

The hierarchical linear regression model applied to explain negative consequences, controlling for age and sex, shows that both alcohol consumption and the PBSS subscales increase the model's explanatory capacity (see Table 3). Using the indicators of alcohol consumption as dependent variables, the MOD subscale scores show increased explanatory capacity for the frequency of alcohol consumption, binge drinking, and drunkenness in the last three months. Further, MOD and SHR subscale scores emerge as significant variables for explaining the amount of alcohol consumed. Non-linearity patterns were not observed in any of these regression models.

In terms of convergent and discriminant evidence, factor analysis revealed a clear and interpretable two-factor solution (Table 4), with factor loadings above 0.40. All YAACQ subscales are included in the first factor, while the PBSS subscales are grouped in the second factor. None of the subscale scores have factor loadings greater than 0.25 on other factors.

Discussion

The present study explored the psychometric properties of the Spanish version of the PBSS-20 (Treloar et al., 2015). To our knowledge, this is the first study to present a Spanish version of an instrument for measuring protective behavioral strategies, and one of the first to conduct a psychometric analysis of the PBSS-

Table 2
Fit statistics: Confirmatory Factor Models of S-PBSS-20

Models	NNFI	CFI	GFI	RMSEA	AIC	S-B$\chi^2_{(df)}$
Model 1: One factor (20 items)	.74	.77	.88	.065	167.78	$507.78_{(170)}$***
Model 2: Two factors: SHR and CC	.83	.84	.91	.054	60.40	$398.40_{(169)}$***
Model 3: Three factors: SHR, SLD and MOD	.88	.89	.93	.045	-6.15	$327.84_{(167)}$***
Model 4: 1-second order factor (PBSS) and 3-first order factors (SHR, SLD, MOD)	.88	.89	.93	.045	-6.15	$327.84_{(167)}$***
Model 5: Four factors: SHR, MOD, SLD-planning limits and SLD-Mixing	.88	.89	.93	.045	-7.64	$320.36_{(164)}$***

Note: NNFI=non-normed fit index; CFI=comparative fit index; GFI = Goodness-of-fit index; RMSEA=root-mean-square error of approximation; AIC = Akaike Information Criterion; S-Bχ^2=Satorra–Bentler scaled χ^2; df=degree of freedom
Model 1=1-Factor model
Model 2=2-Factor model following Madson et al. (2013). Factor 1=SHR, Factor 2=CC (Control Consumption=MOD and SLD).
Model 3=3-Factor model following Treloar et al. (2015)
Model 4=1-Second order factor (PBSS) and 3-first order factors (SHR, SLD, MOD)
Model 5=4-Factor model following Walters et al. (2007): Factor 1=SHR; Factor 2=MOD; Factor 3=SLD-planning limits (items 2, 4, 6, 9); Factor 4=SLD-mixing (items 3, 10, 11).
*** p<0.001

Table 3
Hierarchical linear regression models examining the associations between sociodemographic data, pattern of alcohol use, alcohol-related consequences and protective behavioral strategies in the last three months

	Alcohol-related consequences			**Pattern of alcohol use**											
	(total YAACQ score)			**Frequency of alcohol use**				**Frequency of drunkenness**			**Frequency of binge drinking**			**Quantity of alcohol used**		
	β	**R^2**	**ΔR^2**		**β**	**R^2**	**ΔR^2**	**β**	**R^2**	**ΔR^2**	**β**	**R^2**	**ΔR^2**	**β**	**R^2**	**ΔR^2**
Step 1		0.02	0.02**	Step 1		.00	0.00		0.02	0.02**		0.00	0.00		0.01	0.01
Sex	0.03			Sex	0.03			0.04			0.04			0.07		
Age	-0.15**			Age	0.02			-0.14**			-0.05			-0.07		
Step 2		0.36	0.34***	Step 2		0.08	0.08***		0.14	0.12***		0.13	0.13***		0.09	0.08***
Sex	-0.01			Sex	0.00			0.01			0.00			0.03		
Age	-0.08			Age	0.05			-0.10*			-0.03			-0.06		
Frequency of alcohol use	0.05			MOD	-0.21***			-0.26***			-0.30***			-0.17**		
Frequency of drunkenness	0.33***			SLD	-0.04			-0.08			-0.07			-0.06		
Frequency of binge drinking	0.14*			SHR	-0.09			-0.07			-0.04			-0.14**		
Quantity of alcohol used	0.18***															
Step 3		0.40	0.04***													
Sex	-0.02															
Age	-0.08*															
Frequency of alcohol use	0.05															
Frequency of drunkenness	0.31***															
Frequency of binge drinking	0.11*															
Quantity of alcohol used	0.16**															
MOD	-0.16**															
SLD	0.10*															
SHR	-0.13**															

Note: SHR=Serious Harm Reduction; SLD=Stopping/Limiting Drinking; MOD=Manner of Drinking; PBSS: Protective Behavioral Strategies Scale; YAACQ= Young Adult Alcohol Consequences Questionnaire
* $p<0.05$, ** $p<0.01$, *** $p<0.001$

20. Our results show the adequate psychometric functioning of the scale, with an adequate internal consistency, and provide positive evidence of validity based on the internal structure of the scale and its relationship with other variables of its nomothetic network.

The estimated internal consistency values of the MOD and SLD scales are adequate and similar to those reported previously (Martens et al., 2005; 2007; Richards et al., 2018), although slightly lower than those found by Treloar et al. (2015), Terlecki et al. (2020) and Looby et al. (2019). For the SHR dimension, the values are adequate and generally higher than those of the 15-item version (Martens et al., 2005; Martens et al., 2007), and are highly similar to those reported by Richards et al. (2018) for the PBSS-20, although somewhat lower than those found by other authors (Grazioli et al., 2019; Looby et al., 2019).

The two previous psychometric studies on the PBSS-20 (Grazioli et al., 2019; Richards et al., 2018) did not support the factorial structure of this scale. Our study tested various models, finding that the original three-factor structure of PBSS-20 was the one with the best fit values. Further, the second-order factor model (total PBSS) from first order factors (SHR, SLD, MOD) showed similar fit values to the original three-factor structure. Given that the unidimensional model did not fit, we recommend that the total PBSS score must not be calculated from the original items. Instead, we propose that a total PBSS score could be used if the scores of the items are weighted according to their factor loadings.

Table 4
Factor Solution for alcohol-related consequences and PBSS-20 subscales

Scale dimensions	Factor[1]	
	1	2
YAACQ-Impaired control	0.809	
YAACQ-Social interpersonal	0.756	
YAACQ-Self perception	0.734	
YAACQ-Risky behaviors	0.681	
YAACQ-Blackout drinking	0.660	
YAACQ-Self care	0.564	
YAACQ-Physiological Dependence	0.469	
YAACQ-Academic occupational	0.421	
LSD		0.760
MOD		0.656
SHR		0.570

Note: [1] Factor loadings< .25 have been removed. YAACQ= Young Adult Alcohol Consequences Questionnaire; SHR=Serious Harm Reduction; SLD=Stopping/Limiting Drinking; MOD=Manner of Drinking; PBSS=Protective Behavioral Strategies Scale

Convergent and discriminant analyses also revealed that the S-PBSS-20 dimensions clearly differ from the consequences measured using the YAACQ dimensions. Thus, although the two constructs are related, the PBSS dimensions show theoretical coherence, differentiating from the consequences.

It is well documented that PBS use is associated with fewer alcohol-related negative consequences and a less intensive drinking pattern (Pearson, 2013), as is the case in our study. Numerous studies have shown that the MOD dimension has the strongest relationship with negative consequences and variables related to alcohol use (Frank et al., 2012; García et al., 2018; Terlecky et al., 2020). Consistent with these findings, the multivariate analyses in our study revealed that MOD has the highest regression coefficients of all the five regression models studied and is the only one in which these parameters are statistically significant in all models. Moreover, in terms of incremental validity, multivariate analysis indicates that the PBSS dimensions increased the explanatory capacity regarding consequences and patterns of alcohol consumption (beyond what might be expected on the basis of socio-demographic variables).

Whilst this study provides empirical support for the use of S-PBSS-20, certain limitations must be noted. Previous research has shown that in comparison with college students, non-college students report more frequent binge drinking and more alcohol-related problems (Muthén & Muthén, 2000; Quinn & Fromme, 2011). Further, among young adults (such as the college students in our sample) binge drinking is more prevalent than in adults (WHO, 2018). Our work —as with the original version (Martens et al., 2005) and the PBSS-20 (Treloar et al., 2015)— was conducted with a college student sample, which limits the use of the scale in other subpopulations. Thus, future research should test the psychometric properties of S-PBSS-20 in other subpopulations, particularly non-college samples of young-adults. Further, as in the work of Martens et al. (2005) and Treloar et al. (2015), most of the participants in this study were female. Alcohol use frequency and binge drinking is higher in men than in women (WHO, 2018) and considerable evidence suggests that women use PBS more frequently than men (Pearson, 2013). It is unclear whether gender can affect the invariance of the PBSS-20 structure. Future studies (with large samples) should explore possible gender differences in the use of protective strategies and, more specifically, the factor structure of the PBSS-20. Finally, we transversally obtained evidence of validity based on the relationship with other variables. Since the utility of the PBSS lies in its capacity to predict alcohol-related negative consequences and a less intensive pattern of alcohol use, future studies should test the predictive validity of S-PBSS-20 in relation to these variables.

Considering the evidence of validity and reliability provided in this study and, unlike the French and German versions, our findings support the use of the original three-factor structure PBSS-20 proposed by Treloar et al. (2015). Moreover, in light of our results, when PBSS items are weighted according to their factor loadings, the use of the total PBSS score is supported.

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