International Journal of Clinical and Health Psychology

www.elsevier.es/ijchp

Spanish adaptation and validation of the Barratt Impulsiveness Scale for early adolescents (BIS-11-A)

Víctor Martínez-Loredo[a,*], José Ramón Fernández-Hermida[a,b],
Sergio Fernández-Artamendi[a,b], José Luis Carballo[c], Olaya García-Rodríguez[a]

[a] Universidad de Oviedo, Spain
[b] Biomedical Research Networking Center for Mental Health (CIBERSAM), Spain
[c] Universidad Miguel Hernández de Elche, Spain

Abstract Impulsivity has been associated with several psychiatric disorders such as substance abuse. The Barratt Impulsiveness Scale (BIS-11) is one of the most commonly administered self-reports for the assessment of impulsiveness in both research and clinical settings. There is a version for adolescents called BIS-11-A, which has not been yet properly adapted to Spanish population. The goal of this study is to offer an alternative and more adequate Spanish version of the BIS-1-A, as well as to assess its psychometric properties including factor structure, reliability and predictive validity regarding substance use (last month alcohol, tobacco and cannabis use, presence of last month intoxication, binge drinking and problem drinking). The BIS-11-A and items from the European School Survey Project on Alcohol and other Drugs (ESPAD) were applied to 1,183 students (aged 12-14) at 16 Spanish secondary schools. The BIS-11-A showed a bidimensional factor structure, high reliability (Cronbach's alpha = .87) and good capacity for identifying substance use, binge drinking and problem drinking (sensitivity = 67.3-75%; specificity = 83.4-85.4%). The BIS-11-A Spanish version is a reliable and valid instrument for be used among early adolescents.
© 2015 Published by Elsevier España, S.L.U. on behalf of Asociación Española de Psicología Conductual. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

* Corresponding author: Department of Psychology, Faculty of Psychology, Universidad de Oviedo, Plaza Feijoo sn, 33003, Oviedo, Spain.
E-mail addresses: martinezlvictor@uniovi.es, loredo@cop.es (V. Martínez-Loredo).

Adaptación y validación española de la Escala de Impulsividad de Barratt en adolescentes tempranos (BIS-11-A)

Resumen   La impulsividad ha sido relacionada con multitud de trastornos psiquiátricos como el abuso de sustancias. La Escala de Impulsividad de Barratt (BIS-11) es uno de los autoinformes más comúnmente administrados para la evaluación de la impulsividad tanto en el ámbito clínico como de investigación. Hay una versión para adolescentes llamada BIS-11-A, que aún no ha sido convenientemente adaptada a población española. El objetivo de este estudio es ofrecer una versión española alternativa y más adecuada del BIS-11-A, así como la evaluación de sus características psicométricas tales como estructura factorial, fiabilidad y validez predictiva sobre el uso de sustancias (uso en el último mes de alcohol, tabaco y cánnabis, presencia de borracheras en el último mes, consumo intensivo y problemático de alcohol). El BIS-11-A e ítems de la Encuesta Escolar Europea sobre Alcohol y otras Drogas (ESPAD) fueron aplicados a 1.183 estudiantes (edad 12-14 años) en 16 institutos españoles de Educación Secundaria. El BIS-11-A ha mostrado una estructura bidimensional, alta fiabilidad (alfa de Cronbach = 0,87) y buena capacidad para identificar el uso de sustancias, consumo intensivo y problemático de alcohol (sensibilidad = 67,3-75%; especificidad = 83,4-85,4%). La versión española del BIS-11-A es un instrumento fiable y válido para su uso con adolescentes tempranos.

For many years the study of impulsivity has been a productive research field due to its implications in various psychiatric and behavioral disorders (Alcorn et al., 2013; Lijffijt, Kenemans, Verbaten, & van Engeland, 2005; Powers et al., 2013; Schag et al., 2013; Sobral, Villar, Gómez-Fraguela, Romero, & Luengo, 2013; Voltas Moreso, Hernández-Martínez, Arija Val, & Canals Sans, 2013), and its relationship with several risk behaviors such as substance use (Moreno-Lopez et al., 2012; O'Loughlin, Dugas, O'Loughlin, Karp, & Sylvestre, 2014; Stautz & Cooper, 2013).

The relationship between impulsivity and substance use is a very important issue, since previous studies have pointed out an association between the presence of substances use and other risk behaviors during the adolescents (Cook et al., 2006; Peters et al., 2015; Van Kammen, Loeber, & Stouthamer-Loeber, 1991), a period when substance use starts to occur (Chambers, Taylor, & Potenza, 2003). The median age of onset for substance use disorders is between 14 and 15 years (Merikangas et al., 2010; Swendsen et al., 2012). This early onset increases the risk of having physical and mental health problems in the future (McCambridge, McAlaney, & Rowe, 2011; Rubino, Zamberletti, & Parolaro, 2012).

The relationship between different forms of impulsivity and early use and abuse of different substances has been widely studied (de Wit, 2009). More specifically, some authors have found that disinhibition is directly associated with greater use of substance in girls and indirectly associated in boys (Wood, Dawe, & Gullo, 2013). Higher impulsivity levels in decision-making tasks are significantly correlated with the age of first alcohol, tobacco and cannabis use. More impulsive adolescents are also more likely to experiment and use substances as well as to develop substance use disorders (de Wit, 2009). Concerning the pattern of use, high impulsivity in early adolescents represents an important risk factor for binge drinking (de Wit, 2009) and drug use escalation (Quinn & Harden, 2013).

There is not an agreed scientific definition of impulsivity (Cyders & Coskunpinar, 2011; Stahl et al., 2013; Stautz & Cooper, 2013) but most authors agree that it includes features such as lack of planning, inattention, preference for sooner outcomes or lack of capacity to remain focused on a task (Lejuez et al., 2010; Moeller, Barratt, Dougherty, Schmitz, & Swann, 2001). Concurrently to this theoretical debate, there have been many attempts to develop psychometrically robust instruments to assess impulsiveness. As a result, there are multiple self-report questionnaires available such as the Zuckerman-Kuhlman's ImpSS subscale (Zuckerman, Kuhlman, Joireman, Teta, & Kraft, 1993), the UPPS-P Impulsive Behavior Scale (Cyders et al., 2007), Temperament Inventory Character, TCI (Cloninger, 1994), or the Barratt Impulsiveness Scale, BIS (Patton, Stanford, & Barratt, 1995). However, most of them have been validated with adults, and since they are worded to measure adult behaviors, specific versions for adolescents are needed (Fossati, Barratt, Acquarini, & Di Ceglie, 2002).

The BIS is one of the most commonly administered self-reports for the assessment of impulsiveness in both research and clinical settings (Stanford et al., 2009), and it has been highly influential for contemporary conceptualizations of impulsivity in both personality and clinical literature (Steinberg, Sharp, Stanford, & Tharp, 2013). The last version of this test, the BIS-11, has shown high reliability (Cronbach's α = .83) and high predictive validity to assess high risk behaviors including symptoms of conduct disorders, attention deficit disorders, substance use and suicide attempt, both in adults and adolescents (Salvo & Castro, 2013; Stanford et al., 2009; von Diemen, Szobot, Kessler, & Pechansky, 2007). A version for adolescents and children, BIS-11-A, was developed by Fossati et al. (2002), and

validated in Spain and Colombia only with children (Cosi, Vigil-Colet, Canals, & Lonrenzo-Seva, 2008; Chahin, Cosi, Lorenzo-Seva, & Vigil-Colet, 2010).

A validation with Spanish-speaking adolescents was carried out in Chile with a sample aged between 14 and 19 years old (Salvo & Castro, 2013). However, in this study the version used (Patton et al., 1995) is not properly adapted to adolescent contexts. For example, in this version participants are asked about switching residence or job positions instead of reporting on changes in groups of friends or in their professional interests as grownups, as it is suggested in the adolescents adaptation developed by the original authors (Fossati et al., 2002). Besides, in this study no factor analysis was performed to assess the structure of the self-report and the underlying dimensions. Therefore, it seems that a proper adaptation of the BIS-11-A for Spanish adolescents is needed.

The BIS-11 for adults (Patton et al., 1995) is made up of 30 Likert-type items and its validation provides a global score and three subscores: attentional impulsiveness, motor impulsiveness and non-planning impulsiveness (Oquendo et al., 2001). Nevertheless, its structure still remains unclear when used with adolescents. Some previous studies have replicated this structure with children (Cosi et al., 2008), and with adolescents (Hartmann, Rief, & Hilbert, 2011; von Diemen et al., 2007); although some differences emerged in the composition of each factor. Other authors have found a simpler structure with only two factors, namely, a General Impulsiveness factor including attention, cognitive and motor items, and a Nonplanning Impulsiveness factor (Fossati et al., 2002; Yao et al., 2007).

The goal of this study is to offer an alternative and more adequate Spanish version of the BIS-11-A to overcome limitations of previous adaptations, as well as to assess its psychometric properties including reliability and predictive validity regarding substance use. Moreover, we aim to conduct the first factorial analysis of the Spanish version of the BIS-11-A, contributing to the debate on its components. This report has been written following criteria for being more clear and easier to read (Hartley, 2012).

Method

Participants

Initially, 1,321 students enrolled in the second course of 16 Spanish secondary schools, both public and private, located in three different cities (Gijón, Oviedo and Avilés) were surveyed. Selection of schools was performed following a random stratified and incidental procedure. To control for age effects, data from those adolescents who were older than 15 years old was excluded (see flowchart in Figure 1). A total of 1,236 participants aged 12 to 14 years old were retained. 45.3% of them belong to Gijón, 33.4% to Oviedo and 21.3% to Avilés. In order to detect random answers the Oviedo Infrequency Scale (Fonseca-Pedrero, Paino-Piñeiro, Lemos-Giráldez, Villazón-García, & Muñiz, 2009) was used. Eventually, and following the rules established by the authors of the scale, 53 questionnaires were discarded.
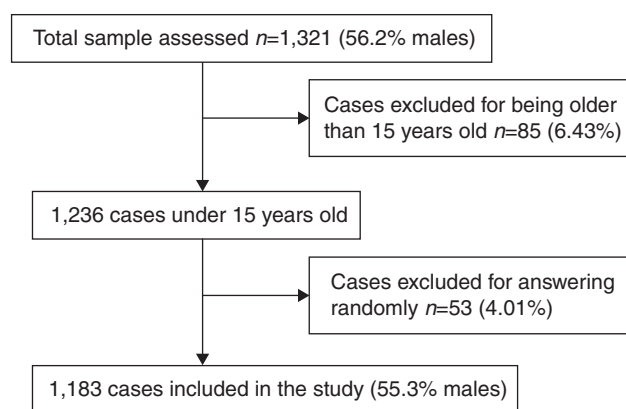

Figure 1 Flowchart of participants entering in the study.

The final sample was made up with 1,183 participants (89.55% of the initial sample). Mean age was 12.98 years ($SD = 0.54$) and 55.3% of them were boys. This age range was selected to assess impulsivity at an early stage before possible interactions with substance use or abuse could take place (Malmberg et al., 2013; Pokhrel, Sussman, Rohrbach, & Sun, 2007). Besides, this would allow clarifying if the BIS-11-A could be used as a screening questionnaire to detect populations in risk of early use or abuse. The majority of the participants (91.8%) were born in Spain, and 71.68% lived with both parents. Participation in the study was voluntary and was approved by the centers and the education authorities. None of the students refused to participate.

Instruments

Sociodemographic data. Participants were required to provide information on their age, school year, gender and country of birth.

Infrequency scale. An infrequency scale was used with the aim of detecting those questionnaires that had been filled up at random or in an erratic manner (Oviedo Infrequency Scale, INF-OV) (Fonseca-Pedrero et al., 2009). This instrument is composed of 12 items mixed throughout the survey. Participants are required to respond to Likert-type items (from totally disagree to totally agree) about obvious facts such as ''I know people who wear glasses'' or ''I have sometimes watched films on TV''. Following the author's rules, participants with more than three wrong answers were excluded.

Impulsivity. A Spanish translation of the BIS-11-A (Cosi et al., 2008; Fossati et al., 2002) was used. This version was independently translated back into English by a professional translator, founding no significant differences between her translation and the original. The BIS-11-A is composed of 30 items with Likert-type questions in which participants report the frequency of different behaviors (1 if rarely or never, 2 if occasionally, 3 if often or 4 if almost always or always). The total score ranged from 30 to 120 and the internal consistency with adolescents (Fossati et al., 2002) was good ($\alpha = .78$).

Substance use. Last month alcohol, tobacco and cannabis use were evaluated using items from the ESPAD (European School Survey Project on Alcohol & Other Drugs, 2007).

Participants were also asked to report the frequency of intoxication episodes and binge drinking in the last month. Binge drinking was defined as the consumption of 5 or more standard drink units (SDUs) -4 or more for women- on a single period of two hours (Parada et al., 2011).

Problem drinking. The presence of problems associated with the use of alcohol was also surveyed using the Spanish version (López-Nuñez, Fernández-Artamendi, Fernández-Hermida, Campillo-Álvarez, & Secades-Villa, 2012) of the Rutgers Alcohol Problem Index, RAPI (White & Labouvie, 1989). This self-report has shown excellent internal consistency reliability (Conbrach α = .91) and predictive validity. Participants have to answer 23 Likert-type items with responses ranging from 0 to 3 on how many times a certain alcohol-related event had occurred over the past year. A cut-off score equal or higher than 7 points is suggested in the Spanish adaptation as indicative of alcohol abuse and dependence among adolescents, so it was used as an indicator of problem drinking.

Procedure

All the questionnaires were computerized and adapted to an electronic tablet framework (Samsung Galaxy Tab2 10.1). The software was designed to warn participants if there were skipping any questions and to avoid making unnecessary queries based on previous answers. Participants were given guarantees of total confidentiality and anonymity by assigning a numerical ID to each student and not retaining any personal data.

Schools were contacted by telephone. Participants filled out the battery during school time, in their own classroom and in a single session with an average of 25 students per classroom. Only specifically-trained researchers supervised the session and explained how to complete the battery without specifying the aim of the study. They also answered any possible questions in case of need. No teaching staff was present.

Data analysis

Descriptive analyses were carried out for each one of the BIS-11-A items and for substance use. An Exploratory Factor Analysis was performed using as input the matrix of polychoric correlations between items (based on scores provided by the Bartlett's Sphericity Test and the Kaiser-Meyer-Olkin Index). The extraction method used was Unweighted Least Squares (ULS) with Promin rotation and the number of factors was determined by Optimal Implementation of Parallel Analyses (PA) (Timmerman & Lorenzo-Seva, 2011) with 1,000 resampling operations. Given the presence of Likert-type items the Least Squares method is the most adequate. More specifically, the ULS showed the best goodness-of-fit and it is consistent with the scale format. Due to the relationship between factors found in previous studies Promin rotation was chosen (Muthén & Muthén, 2010). The goodness-of-fit of the data to the model was established through percentage of total variance explained by the factors, the Goodness-of-Fit Index (GFI) and Root Mean Square of Residuals (RMSR).

Analyses of reliability and predictive validity were also carried out. For the reliability analyses the polychoric

Cronbach's alpha for ordinal data was calculated for the whole scale and for the subscales, if any. Binary logistic regressions were performed to assess predictive validity of the BIS-11-A in relation to substances use and problem drinking. Subsequently, receiver operating characteristic (ROC) curve was analyzed in order to determine the optimum cut-off point for maximizing the sensitivity and specificity of the BIS-11-A in detecting the presence of intoxication episodes, binge drinking and problem drinking.

Data analyses were carried out with SPSS 19.0 and FACTOR 9.2 (Lorenzo-Seva & Ferrando, 2006).

Results

Descriptive statistics

The mean total score of the BIS-11-A was 60.69 (SD = 11.40), and there were significant differences between males (M = 59.98; SD = 11.13) and females (M = 61.57; SD = 11.67), t_{1181} = -2.39, p = .017. However, the magnitude of the differences was very small (η^2 = .005). Table 1 shows the results of the descriptive analysis of the items.

Table 1	Frequency of response on each BIS-11-A item.		
Items BIS	BIS Response alternatives		
	1	2	3	4
1	30.1	38.3	26	5.7
2	46.2	39.3	11.2	3.3
3	15.6	39.4	35.2	9.8
4	47.8	32.5	14	5.6
5	57.5	32	7.8	2.7
6	26.4	41.8	24.1	7.7
7	31.3	36.4	17.3	15
8	48.2	31.4	15.6	4.8
9	24.2	34.8	29.4	11.6
10	45.5	26.5	17.8	10.2
11	52.7	25.6	12.6	9.1
12	21.1	31.8	34.7	12.3
13	22.5	31.5	27	18.9
14	44.3	35.2	15.6	4.9
15	9	20.5	28.8	41.8
16	44	29.2	19.4	7.4
17	47.3	34.2	13.5	5
18	29.3	35.2	19.8	15.7
19	44.9	34.5	14.1	6.5
20	28	42.1	22.9	7
21	78.5	17.8	2.8	0.9
22	69.9	21.2	6.3	2.6
23	13.9	23.3	40.2	22.6
24	74.7	17.2	6.2	1.9
25	69.8	19	6.9	4.2
26	32	37.9	21	9.1
27	13	32.2	30.9	23.9
28	55.5	25.4	12.7	6.4
29	21	21.1	25.4	32.5
30	21.4	33	34	11.7

Note. Frequencies are shown in percentages.

Last month prevalence of alcohol, tobacco and cannabis use was 18.9%, 6.6% and 3.6%, respectively. Regarding last month intoxication episodes, 3.9% of participants referred at least one, and 2.3% of females and 2.4% of males referred binge drinking in the past month. Finally, the mean score of the RAPI was 0.77 ($SD = 4.9$), and 4.1% reported problem drinking according to the RAPI cut-off.

Factor structure

The Kaiser-Meyer-Olkin Index value was .87 and the Bartlett Sphericity test was statistically significant ($\chi^2_{(435, 1183)} = 9035.83$, $p < .001$). Parallel Analyses recommended the extraction of two factors with a total variance explained of 34% (24.7% factor I and 9.3% factor II). Values of both GFI (.95) and RMSR (.065) showed a good fit of data. Factor weights of the factor items ranged from .32 to .80 (Table 2).

The items loaded in factor I were related to General Impulsiveness (attentional, cognitive and motor impulsiveness) and those loaded in factor II were related to Nonplanning Impulsiveness. Items 16, 21, 23, 24 and 27 had weights lower than .30, being not adequate in this sample. Correlation between both factors suggests the presence of a second-order factor of Impulsiveness ($r = .48$).

Reliability

The Cronbach's alpha of internal consistency for ordinal data of the BIS-11-A was .87. The internal consistency of the subscales was .91 and .85 for General Impulsiveness and Nonplanning, respectively. 87% of the items had an item-test correlation higher than .25. However, the internal consistency did not increase when those other items were removed. These results showed that all BIS-11-A items contribute significantly to the total score.

Table 2 Factor weights of each item on the first-order factors and total variance explained.

Items	Factor I	Factor II
(1) *Planifico lo que tengo que hacer* (I plan what I have to do)		.50
(2) *Hago las cosas sin pensarlas* (I do things without thinking)	.64	
(3) *Tomo decisiones rápidamente* (I make up my mind quickly)	.40	
(4) *Soy una persona despreocupada* (I am happy-go-lucky)	.37	
(5) *No presto atención a las cosas* (I do not ''pay attention'')	.49	
(6) *Mis pensamientos van demasiado rápido* (My thoughts are racing too fast)	.57	
(7) *Planifico mi tiempo libre* (I plan my spare time		.44
(8) *Soy una persona que se controla bien* (I am self-controlled	.35	
(9) *Me concentro fácilmente* (I concentrate easily)		.44
(10) *Soy ahorrador* (I am a ''saver'')		.32
(11) *No puedo estar quieto en el cine o en la escuela* (I cannot stand still at movies or school)	.61	
(12) *Me gusta pensar y darle vueltas a las cosas* (I like to think carefully about things)		.41
(13) *Planifico mi futuro* (I plan for my future)		.80
(14) *Digo cosas sin pensarlas* (I say things without thinking)	.79	
(15) *Me gusta pensar en problemas complicados* (I like to think about complex problems)		.50
(16) *Cambio de parecer sobre lo que quiero hacer cuando sea mayor* (I change my mind about what I will do when I grow up)		
(17) *Actúo impulsivamente* (I act ''on impulse'')	.79	
(18) *Me aburro fácilmente cuando trato de resolver problemas mentalmente* (I get easily bored when solving thought problems)		.33
(19) *Actúo según el momento* (I act on the spur of the moment)	.76	
(20) *Pienso bastante bien las cosas* (I am a great thinker)		.64
(21) *Cambio de amigos* (I change friends)		
(22) *Compro cosas por impulse* (I buy things on impulse)	.51	
(23) *Puedo pensar en un solo problema a la vez* (I can think about one problem at a time)		
(24) *Cambio de aficiones y deportes* (I change hobbies and sports)		
(25) *Gasto más de lo que debería* (I spend more than I should)	.42	
(26) *Cuando pienso en algo, otros pensamientos se agolpan en mi mente* (When I think about something, other thoughts pop up in my mind)	.57	
(27) *Estoy más interesado en el presente que en el futuro* (I am more interested in the present than in the future)		
(28) *Estoy inquieto en los cines y en las clases* (I am restless at the movies or lectures)	.64	
(29) *Me gustan los juegos de tablero como el ajedrez, las damas o el parchís* (I like to play chess or checkers)		.35
(30) *Pienso en el futuro* (I am future oriented)		.77
% Total variance	24.7	9.3

Note. Factor loadings < .30 are not shown

Table 3 BIS-11-A sensitivity and specificity according to the area under the ROC curve.

	Sensitivity (95% Confidence Interval)	Specificity (95% Confidence Interval)
Intoxication episodes	82.6% (71.8% - 93.4%)	62.3% (51.5% - 73.1%)
Male binge drinking	75% (64.2% - 85.8%)	83.5% (72.7% - 94.3%)
Female binge drinking	75% (64.2% - 85.8%)	85.1% (74.3% - 95.9%)
Problem drinking	79.6% (68.8% - 90.4%)	64.7% (53.9% - 75.5%)

Predictive validity

The results of logistic regressions indicated a significant predictive power of BIS-11-A for last month substance use and heavy drinking. Concretely, the BIS-11-A offered odds ratios of 1.06 for alcohol (CI95%: 1.05-1.08, $p < .001$), 1.12 for tobacco (CI95%: 1.09-1.15, $p < .001$) and 1.11 for cannabis use (CI95%: 1.08-1.15, $p < .001$). Concerning heavy drinking, the BIS-11-A showed an odds ratio of 1.12 (CI95%: 1.09-1.16, $p < .001$) for last month intoxication episodes, 1.15 (CI95%: 1.09-1.22, $p < .001$) for binge drinking among males and of 1.08 (CI95%: 1.04-1.13, $p < .001$) among females. Finally, logistic regression showed an odds ratio of 1.11 (CI95%: 1.08-1.14, $p < .001$) to predict problem drinking.

The area under the ROC curve was .83 (CI95%: .77-.89) for the presence of intoxication episode, .87 (CI95%: .80-.95) for binge drinking among males, .79 (CI95%: .67-.92) for binge drinking among females and .81 (CI95%: .74-.88) for problem drinking. Sensitivity and specificity indexes according to this area under the curve are shown in Table 3. Nonetheless, due to the high false positive rate in intoxication episodes (37.7%) and problem drinking (35.3%), a more suitable clinical approach was used with this index. This other approach allowed balancing the values of sensitivity and specificity in order to minimize the presence of false positives. Subsequently, the ROC curve indicated that a BIS-11-A total score of 73 maximized the sensitivity and specificity of the impulsiveness level for the detection of intoxication episodes. This threshold showed a sensitivity of 69.6% (CI95%: 58.8%-80.4%) and a specificity of 85.3% (CI95%: 74.5%-96.1%). Therefore, false positive rates were reduced from 37.7% to 14.7%. Regarding problem drinking, a total score of 73 showed a sensitivity of 67.3% (CI95%: 56.5%-78.1%), and a specificity of 85.4% (CI95%: 74.6%-96.2%). Finally, a score of 73 showed a sensitivity of 68.8% (CI95%: 58%-79.6%) in males and 75% (CI95%: 64.2%-85.8%) in females for binge drinking with a specificity of 85.4% (CI95%: 74.6%-96.2%) and 83.4% (CI95%: 72.6%-94.2%), respectively.

Discussion

The purpose of the current study was to adapt the BIS-11-A for its use with Spanish-speaking early adolescents as well as to assess its psychometric properties, factor structure and predictive validity. Due to the relevance of this instrument in the assessment of impulsiveness the availability of an adequate Spanish adaptation of the BIS-11-A is very important for research and clinical purposes. The results show that the BIS-11-A is a valid and reliable self-report for the assessment of impulsiveness, with good criterion validity to predict impulsivity-related outcome such as of problem drinking and high risk drinking patterns in early adolescents.

In our opinion, the previous validation of the BIS-11-A with Spanish-speaking adolescents carried out by Salvo and Castro (2013) seems not to be properly adapted to the adolescent context. Several items (1, 14, 20, 25 and 27) were not reworded to measure adolescent behaviors and characteristics, as it is suggested in the adaptation to adolescents developed by the original authors of the BIS-11-A (Fossati et al., 2002). Others (17 and 23), were not present in the aforementioned version. In our study, we have utilized the reworded items strictly following the recommendations of the original authors, as translated by Chahin et al. (2010). For example, instead of asking the adolescents about ''residence changes'' they are asked about ''switching friendships'', which is the more adequate to the situation of this population and representative of their impulsivity.

Moreover, no replication of the factorial structure of the BIS-11-A has been carried out with Spanish-speaking populations. In our study, the BIS-11-A presents 2 first-order factors named General Impulsiveness (which includes items related to attentional, motor and cognitive aspects of impulsiveness) and Nonplanning Impulsiveness, mainly compounded by items loaded in the Self-Control and Cognitive Complexity factors of Fossati's adaptation. This two factor solution is consistent with previous studies (Fossati et al., 2002; Leshem & Glicksohn, 2007; Yao et al., 2007), although in those studies the structure was created with second-order factors. In any case, a two factor solution seems to be more typical in adolescents than in adults. Moreover, the total explained variance in the Spanish validation is higher than in other validations, even with three factors (von Diemen et al., 2007). This might be caused by the homogeneity of the sample. In our study, the 1183 participants were between 12 and 14 years old, while in the Brazilian version (von Diemen et al., 2007) ages ranged from 15 to 20 years among only 464 students. Concerning factor loadings, three of the five items that presented with low factor weights (''I change friends'', ''I can think about one problem at a time'' and ''I change hobbies and sports'') showed the same pattern in the Italian version (Fossati et al., 2002). However, there is no coincidence with the pattern found in the Brazilian version (von Diemen et al., 2007). Thus, future studies should confirm this two-factor structure with Spanish adolescents and the items adequacy.

The reliability of the Spanish BIS-11-A is high (.87), similar to that found in previous studies (.83) (Stanford et al., 2009) and higher than others (.62 for the Brazilian adaptation and .77 for the Chilean) (Salvo & Castro, 2013; von Diemen et al., 2007). However, due to the developmental changes during the adolescence, further studies

should explore more in-depth the internal consistency and temporal stability of the BIS-11-A along this period.

Concerning the predictive validity, the BIS-11-A seems to be a valid instrument to predict impulsivity linked to last month alcohol, tobacco and cannabis use, as well as to the presence of last month intoxication episodes, binge drinking and last year problem drinking. Sensitivity ranged from 67.3% to 75% and specificity from 83.4% to 85.4%. False positive percentages were lower than 17% for all measures, with a cut-off point of 73 in the total score maximizing the sensitivity and specificity of the BIS-11-A. These results are relevant considering that only one of the factors contributing to substance use (i.e. impulsivity as measured with the BIS-11-A) has been analyzed. Thus, future researches on early adolescents should take into account this instrument due the important role played in early substances use. Nonetheless, more research is required to replicate the reliability of this proposed threshold.

This study has some limitations, such as the absence of other impulsiveness questionnaires to assess the concurrent validity of the instrument. Also, predictive validity is limited due to the cross-sectional design, which precludes actual prospective predictions. Self-reports are considered valid and reliable method to collect information about substance use (Winters, Stinchfield, Henly, & Schwartz, 1990) but, possible under-reporting on the part of the adolescent might be in place.

These limitations notwithstanding, the present study shows that the Spanish adaptation of the BIS-11-A is a reliable, valid and useful questionnaire to assess impulsiveness among early adolescents and to predict related correlates such as problem drinking and other drugs use, with a total score of 73 being the most appropriate cut-off point to maximize the sensitivity of predictions.

Further studies with adolescents could analyze the temporal stability of the instrument and shed some additional light to the factorial structure of the BIS-11-A.

Funding and acknowledgements

References

Alcorn, J. L., Gowin, J. L., Green, C. E., Swann, A. C., Moeller, F. G., & Lane, S. D. (2013). Aggression, impulsivity, and psychopathic traits in combined antisocial personality disorder and substance use disorder. *The Journal of Neuropsychiatry and Clinical Neurosciences*, 25, 229–232. http://dx.doi.org/10.1176/appi.neuropsych.12030060

Cloninger, C. R. (1994). *The temperament and character inventory (TCI): A guide to its development and use*. St. Louis, MO: Center for Psychobiology of Personality, Washington University.

Cook, R. L., Comer, D. M., Wiesenfeld, H. C., Chang, C. C., Tarter, R., Lave, J. R., & Clark, D. B. (2006). Alcohol and drug use and related disorders: An underrecognized health issue among adolescents and young adults attending sexually transmitted disease clinics. *Sexually Transmitted Diseases*, 33, 565–570. http://dx.doi.org/10.1097/01.olq.0000206422.40319.54

Cosi, S., Vigil-Colet, A., Canals, J., & Lonrenzo-Seva, U. (2008). Psychometric properties of the Spanish Adaptation of the Barratt Impulsiveness Scale-11-A for Children. *Psychological Reports*, 103, 336–346. http://dx.doi.org/10.2466/pr0.103.2.336-346

Cyders, M. A., & Coskunpinar, A. (2011). Measurement of constructs using self-report and behavioral lab tasks: Is there overlap in nomothetic span and construct representation for impulsivity? *Clinical Psychology Review*, 31, 965–982. http://dx.doi.org/10.1016/j.cpr.2011.06.001

Cyders, M. A., Smith, G. T., Spillane, N. S., Fischer, S., Annus, A. M., & Peterson, C. (2007). Integration of impulsivity and positive mood to predict risky behavior: Development and validation of a measure of positive urgency. *Psychological Assessment*, 19, 107–118. http://dx.doi.org/10.1037/1040-3590.19.1.107

Chahin, N., Cosi, S., Lorenzo-Seva, U., & Vigil-Colet, A. (2010). Stability of the factor structure of Barrat's Impulsivity Scales for children across cultures: A comparison of Spain and Colombia. *Psicothema, 22, 983–989.*

Chambers, R. A., Taylor, J. R., & Potenza, M. N. (2003). Developmental neurocircuitry of motivation in adolescence: A critical period of addiction vulnerability. *The American Journal of Psychiatry, 160*, 1041–1052, doi: appi.ajp.160.6.1041.

de Wit, H. (2009). Impulsivity as a determinant and consequence of drug use: A review of underlying processes. *Addiction Biology*, 14, 22–31. http://dx.doi.org/10.1111/j.1369-1600.2008.00129.x

European School Survey Project on Alcohol and Other Drugs (2007). *ESPAD Student Questionnaire*. www.espad.org

Fonseca-Pedrero, E., Paino-Piñeiro, M., Lemos-Giráldez, S., Villazón-García, U., & Muñiz, J. (2009). Validation of the Schizotypal Personality Questionnaire—Brief Form in adolescents. *Schizophrenia Research*, 111, 53–60. http://dx.doi.org/10.1016/j.schres.2009.03.006

Fossati, A., Barratt, E. S., Acquarini, E., & Di Ceglie, A. (2002). Psychometric properties of an adolescent version of the Barratt Impulsiveness Scale-11 for a sample of Italian high school students. *Perceptual and Motor Skills*, 95, 621–635. http://dx.doi.org/10.2466/pms.2002.95.2.621

Hartley, J. (2012). New ways of making academic articles easier to read. *International Journal of Clinical and Health Psychology, 12, 143–160.*

Hartmann, A. S., Rief, W., & Hilbert, A. (2011). Psychometric properties of the German version of the Barratt Impulsiveness Scale, Version 11 (BIS-11) for adolescents. *Perceptual and Motor Skills*, 112, 353–368. http://dx.doi.org/10.2466/08.09.10.PMS.112.2.353-368

Lejuez, C. W., Magidson, J. F., Mitchell, S. H., Sinha, R., Stevens, M. C., & de Wit, H. (2010). Behavioral and biological indicators of impulsivity in the development of alcohol use, problems, and disorders. *Alcoholism, Clinical and Experimental Research*, 34, 1334–1345. http://dx.doi.org/10.1111/j.1530-0277.2010.01217.x

Leshem, R., & Glicksohn, J. (2007). The construct of impulsivity revisited. *Personality and Individual Differences, 43*, 681–691. http://dx.doi.org/10.1016/j.paid.2007.01.015

Lijffijt, M., Kenemans, J. L., Verbaten, M. N., & van Engeland, H. (2005). A meta-analytic review of stopping performance in attention-deficit/hyperactivity disorder: Deficient inhibitory motor control? *Journal of Abnormal Psychology*, 114, 216–222. http://dx.doi.org/10.1037/0021-843X.114.2.216

López-Nuñez, C., Fernández-Artamendi, S., Fernández-Hermida, J. R., Campillo-Álvarez, A., & Secades-Villa, R. (2012). Spanish Adaptation and Validation of the Rutgers Alcohol Problems Index

(RAPI). *International Journal of Clinical and Health Psychology, 12*, 251–264.

Lorenzo-Seva, U., & Ferrando, P. J. (2006). FACTOR: A computer program to fit the exploratory factor analysis model. *Behavior Research Methods, 38*, 88–91. http://dx.doi.org/10.3758/BF03192753

Malmberg, M., Kleinjana, M., Overbeek, G., Vermulst, A. A., Lammers, J., & Engels, R. (2013). Are there reciprocal relationships between substance use risk personality profiles and alcohol or tobacco use in early adolescence? *Addictive Behaviors, 38*, 2851–2859. http://dx.doi.org/10.1016/j.addbeh.2013.08.003

McCambridge, J., McAlaney, J., & Rowe, R. (2011). Adult consequences of late adolescent alcohol consumption: A systematic review of cohort studies. *PLoS Medicine, 8* http://dx.doi.org/10.1371/journal.pmed.1000413

Merikangas, K. R., He, J. P., Burstein, M., Swanson, S. A., Avenevoli, S., Cui, L., Benjet, C., Georgiades, K., & Swendsen, J. (2010). Lifetime prevalence of mental disorders in U.S. adolescents: Results from the National Comorbidity Survey Replication–Adolescent Supplement (NCS-A). *Journal of the American Academy of Child and Adolescent Psychiatry, 49*, 980–989. http://dx.doi.org/10.1016/j.jaac.2010.05.017

Moeller, F. G., Barratt, E. S., Dougherty, D. M., Schmitz, J. M., & Swann, A. C. (2001). Psychiatric aspects of impulsivity. *American Journal of Psychiatry, 158*, 1783–1793. http://dx.doi.org/10.1176/appi.ajp.158.11.1783

Moreno-Lopez, L., Catena, A., Fernandez-Serrano, M. J., Delgado-Rico, E., Stamatakis, E. A., Perez-Garcia, M., & Verdejo-Garcia, A. (2012). Trait impulsivity and prefrontal gray matter reductions in cocaine dependent individuals. *Drug Alcohol Depend, 125*, 208–214. http://dx.doi.org/10.1016/j.drugalcdep.2012.02.012

Muthén, L. K., & Muthén, B. O. (2010). *Mplus User's Guide* (Sixth ed.). Los Ángeles, CA: Muthén & Muthén.

O'Loughlin, J. L., Dugas, E. N., O'Loughlin, E. K., Karp, I., & Sylvestre, M. P. (2014). Incidence and determinants of cigarette smoking initiation in young adults. *The Journal of Adolescent Health: Official Publication of the Society for Adolescent Medicine, 54*, 26–32. http://dx.doi.org/10.1016/j.jadohealth.2013.07.009

Oquendo, M. A., Baca-Garcia, E., Graver, R., Morales, M., Montalvan, V., & Mann, J. J. (2001). Spanish adaptation of the Barratt Impulsiveness Scale (BIS-11). *European Journal of Psychiatry, 15*(3), 147–155.

Parada, M., Corral, M., Caamano-Isorna, F., Mota, N., Crego, A., Rodriguez Holguin, S., & Cadaveira, F. (2011). Definition of adolescent binge drinking. *Adicciones, 23*, 53–63.

Patton, J. H., Stanford, M. S., & Barratt, E. S. (1995). Factor structure of the Barratt impulsiveness scale. *Journal of Clinical Psychology, 51*, 768–774. http://dx.doi.org/10.1002/1097-4679

Peters, E. N., Nordeck, C., Zanetti, G., O'Grady, K. E., Serpelloni, G., Rimondo, C., Blanco, C., Welsh, C., & Schwartz, R. P. (2015). Relationship of gambling with tobacco, alcohol, and illicit drug use among adolescents in the USA: Review of the literature 2000-2014. *American Journal on Addition, 24*, 206–216. http://dx.doi.org/10.1111/ajad.12214

Pokhrel, P., Sussman, S., Rohrbach, L. A., & Sun, P. (2007). Prospective associations of social self-control with drug use among youth from regular and alternative high schools. *Substance Abuse Treatment, Prevention, and Policy, 2*, 22. http://dx.doi.org/10.1186/1747-597X-2-22

Powers, R. L., Russo, M., Mahon, K., Brand, J., Braga, R. J., Malhotra, A. K., & Burdick, K. E. (2013). Impulsivity in bipolar disorder: Relationships with neurocognitive dysfunction and substance use history. *Bipolar Disorders, 15*, 876–884. http://dx.doi.org/10.1111/bdi.12124

Quinn, P. D., & Harden, K. P. (2013). Differential changes in impulsivity and sensation seeking and the escalation of substance use from adolescence to early adulthood. *Development and Psychopathology, 25*, 223–239. http://dx.doi.org/10.1017/S0954579412000284

Rubino, T., Zamberletti, E., & Parolaro, D. (2012). Adolescent exposure to cannabis as a risk factor for psychiatric disorders. *Journal of Psychopharmacology, 26*, 177–188. http://dx.doi.org/10.1177/0269881111405362

Salvo, G. L., & Castro, S. A. (2013). Confiabilidad y validez de la escala de impulsividad de Barratt (BIS-11) en adolescentes. *Revista Chilena de Neuro-psiquiatría, 51*, 245–254. http://dx.doi.org/10.4067/S0717-92272013000400003

Schag, K., Teufel, M., Junne, F., Preissl, H., Hautzinger, M., Zipfel, S., & Giel, K. E. (2013). Impulsivity in binge eating disorder: Food cues elicit increased reward responses and disinhibition. *PLoS One, 8*, e76542. http://dx.doi.org/10.1371/journal.pone.0076542

Sobral, J., Villar, P., Gómez-Fraguela, J. A., Romero, E., & Luengo, M. A. (2013). Interactive effects of personality and separation as acculturation style on adolescent antisocial behaviour. *International Journal of Clinical and Health Psychology, 13*, 25–31.

Stahl, C., Voss, A., Schmitz, F., Nuszbaum, M., Tuscher, O., Lieb, K., & Klauer, K. C. (2013). Behavioral Components of Impulsivity. *Journal of Experimental Psycholy: General, 143*, 850–860. http://dx.doi.org/10.1037/a0033981

Stanford, M. S., Mathias, C. W., Dougherty, D. M., Lake, S. L., Anderson, N. E., & Patton, J. H. (2009). Fifty years of the Barratt Impulsiveness Scale: An update and review. *Personality and Individual Differences. 47*, 385–395. http://dx.doi.org/10.1016/j.paid.2009.04.008

Stautz, K., & Cooper, A. (2013). Impulsivity-related personality traits and adolescent alcohol use: A meta-analytic review. *Clinical Psychology Review, 33*, 574–592. http://dx.doi.org/10.1016/j.cpr.2013.03.003

Steinberg, L., Sharp, C., Stanford, M. S., & Tharp, A. T. (2013). New tricks for an old measure: the development of the Barratt Impulsiveness Scale-Brief (BIS-Brief). *Psychological Assessment, 25*, 216–226. http://dx.doi.org/10.1037/a0030550

Swendsen, J., Burstein, M., Case, B., Conway, K. P., Dierker, L., He, J., & Merikangas, K. R. (2012). Use and Abuse of Alcohol and Illicit Drugs in US Adolescents. Results of the National Comorbidity Survey–Adolescent Supplement FREE. *Archives of General Psychiatry, 69*, 390–398. http://dx.doi.org/10.1001/archgenpsychiatry.2011.1503

Timmerman, M. E., & Lorenzo-Seva, U. (2011). Dimensionality Assessment of Ordered Polytomous Items with Parallel Analysis. *Psychological Methods, 16*, 209–220. http://dx.doi.org/10.1037/a0023353

Van Kammen, W. B., Loeber, R., & Stouthamer-Loeber, M. (1991). Substance use and its relationship to conduct problems and delinquency in young boys. *Journal of Youth and Adolescence, 20*(4), 399–413.

Voltas Moreso, N., Hernández-Martínez, C., Arija Val, V., & Canals Sans, J. (2013). Socio-demographic and psychopathological risk factors in obsessive-compulsive disorder: Epidemiologic study of school population. *International Journal of Clinical and Health Psychology, 13*, 118–126. http://dx.doi.org/10.1016/S1697-2600(13)70015-2

von Diemen, L., Szobot, C. M., Kessler, F., & Pechansky, F. (2007). Adaptation and construct validation of the Barratt Impulsiveness Scale (BIS 11) to Brazilian Portuguese for use in adolescents. *Revista Brasileira de Psiquiatria, 29*, 153–156. http://dx.doi.org/10.1590/S1516-44462006005000020

White, H. R., & Labouvie, E. W. (1989). Towards the assessment of adolescent problem drinking. *Journal of Studies on Alcohol, 50*, 30–37. http://dx.doi.org/10.15288/jsa.1989.50.30

Winters, K. C., Stinchfield, R. D., Henly, G. A., & Schwartz, R. H. (1990). Validity of adolescent self-report of alcohol and other drug involvement. *The International Journal of the Addictions, 25*, 1379–1395. http://dx.doi.org/10.3109/10826089009068469

Wood, A. P., Dawe, S., & Gullo, M. J. (2013). The role of personality, family influences, and prosocial risk-taking behavior on substance use in early adolescence. *Journal of Adolescence, 36*, 871–881. http://dx.doi.org/10.1016/j.adolescence.2013.07.003

Yao, S., Yang, H., Zhu, X., Auerbach, R. P., Abela, J. R., Pulleyblank, R. W., & Tong, X. (2007). An examination of the psychometric properties of the Chinese version of the Barratt Impulsiveness Scale, 11th version in a sample of Chinese adolescents. *Perceptual and Motor Skills, 104*, 1169–1182. http://dx.doi.org/10.2466/pms.104.4.1169-1182

Zuckerman, M., Kuhlman, D. M., Joireman, J., Teta, P., & Kraft, M. (1993). A Comparison of Three Structural Models for Personality: The Big Three, The Big Five, and The Alternative Five. *Journal of Personality and Social Psychology, 65*, 757–768. http://dx.doi.org/10.1037/0022-3514.65.4.757