Psychiatry Research 272 (2019) 744–755

Contents lists available at ScienceDirect

Psychiatry Research

journal homepage: www.elsevier.com/locate/psychres

Thai adaptation and reliability of three versions of the Barratt Impulsiveness Scale (BIS 11, BIS-15, and BIS-Brief)

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ARTICLE INFO

Keywords:
Thailand
Impulsivity
Test-retest reliability
CFA

ABSTRACT

Long, short, and brief versions of the Barratt Impulsiveness scale (BIS-11, BIS-15, and BIS-Brief) were tested in an adult Thai population. The BIS-11T and BIS-15T were translated, back-translated, and administered to a non-clinical population (n = 305) of native Thai speakers who returned 2 weeks later for re-test. BIS-Brief-T psychometrics were calculated post-hoc. Impulsivity scores were normally distributed for the BIS-11T and BIS-15T, but not BIS-Brief-T. Excellent internal consistency was observed, with Cronbach's alpha coefficients above 0.80 for all translated instruments: BIS-11T (α = 0.86), BIS-15T (α = 0.81), BIS-Brief-T (α = 0.81). A total of 260 participants completed both instruments (85%), with test-retest reliability exceeding r = 0.81. All three instruments were highly correlated (r = 0.83–0.89). Confirmatory factor analysis supports a three factor structure (attention, motor, non-planning) for BIS-15T and two factor structure for BIS-11T. BIS scales can support measurement of a range of impulsivity scores in an adult Thai population, though predictive validity of these scales remains unexplored.

1. Introduction

Impulsivity is a behavioral construct characterized by (1) an impairment of behavioral or response inhibition and (2) an inability to delay gratification (Evenden, 1999; Green and Myerson, 2013; Stolerman et al., 2015). Impulsivity can be considered on a continuous scale, with high levels associated with various psychopathologies including substance use disorder, conduct disorder, certain types of attention deficit/hyperactivity disorder, gambling addictions, delinquency, and bulimic-spectrum eating disorders (White et al., 1994; Luman et al., 2010; Robbins et al., 2012; Weafer et al., 2014; Lavender and Mitchell, 2015; Meule and Platte, 2015). Likewise, lowest impulsivity levels have been associated with compulsivity, obsessive compulsive disorder, and food-restricting types of anorexia nervosa (Fineberg et al., 2010; Dalley et al., 2011; Lavender et al., 2017). However, impulsivity may not be limited to clinical phenotypes, as daily decision-making can be influenced by impulsivity (Franken et al., 2008). For example, impulsivity may affect daily health behavior decisions, such as postponing exercise or selecting poor eating behaviors (Sarmugam and Worsley, 2015; van Beurden et al., 2016; Kotbagi et al., 2017). Thus, the fields of health promotion and chronic disease management are increasingly exploring impulsivity as an important factor that may influence initiation or maintenance of health behaviors, with increasing consideration given to the reward schedule of health interventions needed to motivate and retain individuals in intervention research.

The Barratt Impulsiveness Scale (BIS) remains one of the most widely used self-report tools for assessing impulsivity among adolescents and adults in clinical and non-clinical populations (Patton et al., 1995; Swann et al., 2002; Spinella, 2007; Stanford et al., 2009; Nandagopal et al., 2011; Reise et al., 2013; Steinberg et al., 2013). Items on Patton and colleagues' 30-item scale (BIS, version 11; or BIS-11) demonstrate good evidence for construct validity, re-test reliability, and the scale has been translated for use in German (Preuss et al., 2008; Hartmann et al., 2011), Italian (Fossati et al., 2001; Fossati et al., 2002), Japanese (Someya et al., 2001), Portuguese (von Diemen et al., 2007; Malloy-Diniz et al., 2015), Arabic (Ellouze et al., 2013), Dutch (Goudriaan et al., 2008), French (Bayle et al., 2000), Hebrew (Glicksohn and Nahari, 2007), Estonian (Paaver et al., 2007), Spanish (Oquendo et al., 2001), and Chinese (Yao et al., 2007; Lu et al., 2012; Huang et al., 2013). Psychometric properties for each of these scales is described in Table A of the appendix, which describe internal reliability

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https://doi.org/10.1016/j.psychres.2018.12.173
Received 17 July 2018; Received in revised form 20 December 2018; Accepted 30 December 2018
Available online 31 December 2018

coefficients for the English BIS-11 total score ranging from α = 0.72–0.83 (Stanford et al., 2009; Steinberg et al., 2013). Similar reliability coefficients were reported for translated versions (α = 0.68–0.87). Evidence for good test-retest reliability (r = 0.83) has been observed for original (Stanford et al., 2009) and translated scales (r = 0.66–0.89), as impulsivity is thought to be a generally stable trait . The scale has been used with a wide age range of participants, including children/ adolescents (von Diemen et al., 2007; Cosi et al., 2008; Hartmann et al., 2011; Martinez-Loredo et al., 2015) and the elderly (Tamam et al., 2014). Shorter versions of the BIS were developed more recently, such as the 15 item BIS-15 (Spinella, 2007) and 8 item BIS-Brief (Steinberg et al., 2013). These scales were internally reliable in their respective studies with supporting evidence of predictive validity when compared against the longer instrument and other impulsivity measures. These shorter instruments permit increasing use in epidemiological studies by minimizing survey burden due to less time needed to complete the instruments while measuring constructs of interest. To date, the BIS-15 has been translated for use in German (Meule et al., 2011), Spanish (Orozco-Cabal et al., 2010), and French (Rousselle and Vigneau, 2016), with internal reliability of translated versions (α = 0.71–0.81 for total score) comparable to the English version (α = 0.81).

To support use of the BIS with a Thai population, this manuscript describes the translation, internal reliability, test-retest reliability, and construct validity of the BIS-11, BIS-15, and BIS-Brief instruments in an adult Thai population. This study was not designed to be causal nor to clinically distinguish pathological levels of impulsivity, but rather to evaluate whether the BIS was able to measure a range of scores in a Thai population that would support further testing of the instruments in population research.

2. Methods

2.1. Settings and ethical considerations

This multi-center research was approved by Ethics Committee for Human Research of Bangkok Hospital (Institutional Review Board #COA-2016-021). All individuals provided written informed consent prior to participation. Instrument testing was conducted across three Bangkok, Thailand hospital sites: Bangkok Hospital Headquarters, Bangkok Phrapradaeng Hospital, and Phyathai 2 Hospital under the supervision of its hospital directors.

2.2. Instruments

Two versions of the BIS instrument were tested with Thai populations, BIS-11 and BIS-15. A subset of 8 questions from the BIS-11 were analyzed post-hoc to compute descriptive statistics for the BIS-Brief. Questions and translations included in each instrument can be found in the Appendix, Table A1.

- Long form (BIS-11) – The BIS, version 11 comprised 30 items measured on a 4-point Likert scale (1 = rarely/never; 2 = occasionally; 3 = often; 4 = almost always/always), with eleven items reverse scored (Patton et al., 1995). The total score for BIS-11 can be calculated by summing item responses, with scores ranging from 30–120, the latter denoting the highest impulsivity score on the scale. The BIS-11 was published with six first order subscales (Self-Control [SC, 6 items), Motor [M, 7 items], Attention [A, 5 items], Cognitive Instability [CI, 3 items], Cognitive Complexity [CC, 5 items] and Perseverance [P, 4 items] as well as three second order subscales (Attentional [A, 8 items], Motor [M, 11 items], and Non-

Table 1
Participant demographics obtained during first visit.

Factor	Total n = 305	(%)	Site 1 n = 100	(%)	Site 2 n = 105	(%)	Site 3 n = 100	(%)
Age (years)								
mean = 32.6; **SD** = 9.2								
18–30	163	(53.4)	100	(100.0)	31	(29.5)	32	(32.0)
31–41	79	(25.9)	–		48	(45.7)	31	(31.0)
41–50	44	(14.4)	–		16	(15.2)	28	(28.0)
51–60	17	(5.6)	–		10	(9.5)	7	(7.0)
More than 60	2	(0.7)	–		–		2	(2.0)
Gender								
Male	154	(50.5)	86	(86.0)	46	(43.8)	22	(22.0)
Female	151	(49.5)	14	(14.0)	59	(56.2)	78	(78.0)
Education								
Less than bachelor	57	(18.7)	–		6	(5.7)	51	(51.0)
Bachelor	224	(73.4)	95	(95.0)	82	(78.1)	47	(47.0)
Master or higher	20	(6.6)	5	(5.0)	15	(14.3)	–	
Other	4	(1.3)	–		12	(1.9)	2	(2.0)

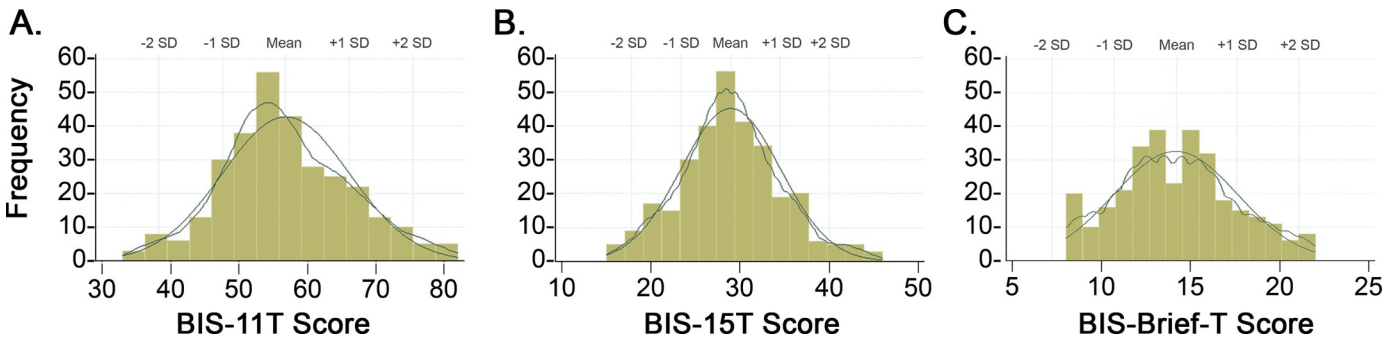

Fig. 1. Score distributions of A) BIS-11T, B) BIS-15T, and C) BIS-Brief-T in a Thai population measured at the first visit compared to normal curve.

Planning [NP, 11 items]; (Patton et al., 1995), though its factor structure has been debated (Haden and Shiva, 2008; Stanford et al., 2009; Reise et al., 2013). Haden and Shiva (2008) describe a 24-item 2 factor structure comprising Motor (M, 12 items) and Non-Planning (NP, 12 items) factors, with scores ranging from 24–96 points. Reise et al. (2013) describe a 28-item, 2 factor structure (F1 [16 items] and F2 [12 items]) that was also tested in the current study (score range: 28–112). Scoring procedures and factor structures for the BIS-11 are described in Table 6.

- Short form (BIS-15) – The BIS-15 (Spinella, 2007) comprised 15 items measured on the same 4-point Likert scale as the longer instrument, with six items reverse scored. Total score ranges from 15–60, the latter denoting the highest impulsivity score on the scale. Total scale is typically reported for the BIS-15, though A, M, and NP subscales can be computed based on five items in each subscale. Cronsbach's alpha coefficients (α) for the instrument range from 0.71–0.81 (Appendix, Table A1), with subscales ranging between α = 0.60–0.78 in a sample of university students.(Meule et al., 2015). Two items in BIS-15 were previously reworded (Spinella, 2007), with the re-wording used for translations in the present study. Specifically, BIS-11′s "I am restless at the theater or lectures" was previously changed to "I am restless at lectures or talks" and "I am future-oriented" was previously reworded to "I plan for the future." This item phrasing is consistent with wording found in the BIS-11a, an earlier version of the BIS-11 instrument (Lijffijt, 2011). The BIS-15 factor structure was also computed as previously reported (Spinella, 2007), with three items applying a different factor structure than reported in BIS-11, but consistent with the BIS-11a (Lijffijt, 2011).
- Brief form (BIS-Brief) – The BIS-Brief comprised 8 items measured on the same 4-point Likert scale, with three items reverse scored. (Steinberg et al., 2013) All 8 items stem from the BIS-11, with 7 items also present in BIS-15. The unidimensional BIS-Brief reports total score only (range of 8–32), with internal reliability ranging from α = 0.73–0.83.

2.3. Procedures for Thai adaptation

2.3.1. Translation process

Due to the BIS-Brief having identical questions to the BIS-11, only the BIS-11 and BIS-15 underwent translation. Both instruments were independently translated as stand-alone scales to support internal consistency checks among the translation team and also due to BIS-15 having different wording on two items. Six translators were involved in the translation process. Forward translations on the two scales were performed by two bilingual scientists, whose work was consolidated into a single version by two additional bilingual scientists (R.J. and C.K.). Any language discrepancies were resolved during the process of reconciliation. As impulsivity is considered to be culturally negative in Thai, instrument wording was carefully verified to minimize negative connotations and ensure meanings were similar between Thai and English (e.g., in Thai, "task" refers to office work, therefore the word selected for "task" was broadened to be comparable to the English version). Two external bilingual translators then independently completed backwards translation with consolidation by two bilingual scientists (R.J. and C.K.) who checked the translations against the original instrument texts.

2.3.2. Cognitive debriefs and face validity testing

Due to cultural differences between western and Thai populations, translations underwent a cognitive debrief at Phrapradaeng Hospital outside of Bangkok, Thailand in September 2016 with four hospital workers in a focus group-like setting. Individuals were asked to complete both instruments, with 20 minutes allotted for completion. As a group, individuals were then asked about each question in Thai to understand comprehension and agreement, as well as accordance of the phrasing between the BIS-11T and BIS-15T surveys. Results were used to clarify initial phrasing. Revised instruments were examined for face validity by a Thai psychiatrist from Bangkok Hospital to ensure wording was culturally- and scientifically-appropriate. A second cognitive

Table 2
Normality of the Thai BIS instruments, with $p < 0.05$ denoting a non-normal distribution.

Instrument	Shapiro-Francia	Shapiro-Wilk	Skewness/ Kurtosis
BIS-11T	0.078	0.050	0.092
BIS-15T	0.296	0.212	0.340
BIS Brief-T	0.724	0.283	0.034

Table 3
Descriptive statistics and internal reliability of the Thai BIS instruments.

Instrument	Visit 1 Mean (SD) (n = 305)	Cronsbach's α	Visit 2 Mean (SD) (n = 260)	Cronsbach's α
BIS-11T				
Total	**56.8 (9.3)**	**0.86**	**56.1 (9.8)**	**0.89**
Patton 2nd Order Factor				
Attentional	15.4 (3.0)	0.67	15.2 (3.1)	0.72
Motor	19.4 (3.7)	0.71	19.1 (3.8)	0.78
Non-Planning	22.0 (4.2)	0.73	21.8 (4.4)	0.78
Patton 1st Order Factor				
Attention	9.4 (2.3)	0.65	9.3 (2.2)	0.73
Cognitive Instability	6.0 (1.4)	0.53	5.9 (1.4)	0.44
Motor	13.2 (3.1)	0.77	13.0 (3.2)	0.81
Perseverance	6.2 (1.4)	0.20	6.1 (1.4)	0.38
Cognitive Complexity	10.6 (2.9)	0.40	10.5 (2.9)	0.48
Self-Control	11.4 (2.2)	0.80	11.3 (2.2)	0.83
Haden & Shiva Factors				
Total	**46.0 (8.2)**	**0.86**	**45.4 (8.6)**	**0.89**
Motor	22.3 (4.6)	0.81	21.9 (4.9)	0.85
Non-Planning	23.7 (4.9)	0.81	23.4 (5.1)	0.85
Reise Factors				
Total	**52.8 (8.7)**	**0.85**	**52.1 (9.2)**	**0.88**
Factor 1	31.5 (5.8)	0.79	31.1 (6.2)	0.84
Factor 2	21.3 (4.1)	0.77	21.0 (4.4)	0.82
BIS-15T				
Total	**28.7 (5.6)**	**0.81**	**28.5 (5.6)**	**0.84**
Attentional	9.6 (2.3)	0.66	9.4 (2.2)	0.70
Motor	10.1 (2.5)	0.73	9.7 (2.4)	0.75
Non-Planning	9.3 (2.4)	0.74	9.4 (2.5)	0.80
BIS Brief-T				
Total	**14.2 (3.5)**	**0.81**	**14.0 (3.5)**	**0.84**

BIS-11T was assessed for Patton's original 6 factor and 3 factor structures (Patton et al., 1995), Haden & Shiva's 24-item, 2 factor solution representing Motor (M, 12 items) and Non-Planning (NP, 12 items) subscales (Haden and Shiva, 2008), as well as Reise et al.'s 28-item, 2 factor structure (Reise et al., 2013). The BIS-15T was assessed for the 3 factor structure (Spinella, 2007) while the one factor structure was analyzed for the BIS-BriefT (Steinberg et al., 2013). While each of the BIS scales differed in number of items, means were proportional across the scales. For example, for BIS-11T total scores, the mean score of 56.8 pts out of 120 possible pts equated to 47.3%, which was roughly equivalent to means observed when testing the factor structures of Haden & Shiva (46.0/96 pts = 47.9%), Reise et al. (52.8/112 pts = 47.1%), BIS-15T (28.7/60 pts = 47.8%), and BIS-BriefT (14.2/32 pts = 44.4%).

Table 4
Correlation between BIS-11T, BIS-15T, and BIS-Brief-T at time of first visit, with results of Pearson product moment correlations (r) suggesting good test-retest reliability at two weeks.

	First Visit BIS-11T	BIS-15T	BIS-Brief-T	**Test-Retest Reliability** Two weeks, $n = 260$
BIS-11T	–	0.83	0.89	0.84 (0.80 to 0.87, $p < 0.001$)
BIS-15T	0.83	–	0.83	0.81 (0.76 to 0.85 $p < 0.001$)
BIS-Brief-T	0.89	0.83	–	0.81 (0.77 to 0.85, $p < 0.001$)

debrief with four naive individuals was then held at Phrapradaeng Hospital in October 2016. These individuals reported clarity of the wording used in BIS-11 and BIS-15 surveys. Final wording used in this study is provided in the Appendix, Table B1.

2.4. Procedures for testing

2.4.1. Participants and settings

Participants were recruited between November 2016 and January 2017 from a completed out-patient health intervention study about diet and physical activity. Nurse coordinators at each site presented information about the study and obtained informed consent. Inclusion criteria were Thai individuals aged 18 years or older, able to participate in both test-retest visits, literate in reading and writing the Thai language, and enrolled in the Thai check-up system (i.e., an annual health care check-up visit for insured individuals in Thailand (Shannon et al., 2017).

2.4.2. Data collection

Consented individuals were given paper versions of the Thai BIS-11 (BIS-11T) and BIS-15 (BIS-15T), with a demographics form attached. Participants were given approximately 20 minutes to complete both questionnaires and asked to return two weeks later to complete the same questionnaires.

2.4.3. Statistical analyses

Survey data were entered by two Bangkok hospital research staff independently, with data cleaned, combined, and analyzed using Stata, version 15. Participant demographics were characterized using descriptive statistics. Total scores and sub-scores were summed for BIS-11T and BIS-15T. BIS-Brief-T scores were computed post-hoc from BIS-11T questions. Normality was determined using Shapiro-Francia, Shapiro-Wilk (S-W), and Skewness-Kurtosis (S-K) tests, with $p < 0.05$ denoting non-normal distributions (Ghasemi and Zahediasl, 2012).

Internal consistency, which describes the level of correlation among items of a questionnaire, was calculated using Cronbach's alpha reliability coefficient, with consistency of the items interpreted as follows: $\alpha < 0.6$ (unacceptable), $\alpha = 0.6–0.65$ (undesirable), $\alpha = 0.65–0.70$ (minimally acceptable), $\alpha = 0.70–0.80$ (respectable), $\alpha = 0.80–0.90$ (excellent), and $\alpha > 0.9$ (excessive consistency) based on previously reported guidelines (Peterson, 1994). Correlation between each of the BIS-T scales was calculated using Pearson correlation coefficients at the time of the first visit. Test-retest reliability over a two-week period was assessed using Pearson product moment correlation coefficients (r) to show correlations between the total score of the first and second visits. Test-retest statistics should be greater than 0.7 for acceptability (Paiva et al., 2014).

Finally, we used confirmatory factor analysis (CFA) to examine factor structure and item loading for BIS-11 T and BIS-15T using the structural equation model technique. BIS-11T was assessed for Patton's original 6 factor and 3 factor structures (Patton et al., 1995), Haden & Shiva's 24-item, 2 factor solution (Haden and Shiva, 2008), as well as Reise et al.'s 28-item, 2 factor structure (Reise et al., 2013). Reise and colleagues' two factor solution includes: Factor 1 (16 items from question parcels 2, 4, 7, 8, 9, and 11) and Factor 2 (12 items from parcels 1, 3, 5, 6, 10). While parcels 8 and 10 are cross-loaded to both factors, personal communication with the author (Moore, 2017) confirmed parcels should travel with the higher loading only, rather than be deleted from both factors since cross-loadings differ by <0.10 (Tabachnick and Fidell, 2012; Watson, 2017). The BIS-15T was assessed for the 3 factor structure (Spinella, 2007) while the one factor structure was analyzed for the BIS-Brief-T (Steinberg et al., 2013).

Chi square tests are highly sensitive to sample size and are often significant with larger samples (Bentler and Bonett, 1980; Reise et al., 1993). Therefore, goodness of fit was instead triangulated using four statistical tests (Marsh et al., 2004; Hopwood and Donnellan, 2010): standard root mean square residual (SRMR; Joreskog and Sorbom, 1988), root mean square error of approximation (RMSEA; Steiger, 2007), comparative fit index (CFI, Bentler, 1990) and Tucker-Lewis index (TLI, Tucker and Lewis, 1973). SRMR is a direct way of measuring discrepancy between data and model since it is the only metric of the four not calculated using chi square (Prudon, 2015). SRMR and RMSEA values of 0 indicate a perfect fit with recommended cutoff values of SRMR ≤ .08 and RMSEA ≤ .06 indicative of a good fit (Hu and Bentler, 1998, 1999). Likewise, normalized CFI and TLI values of 1 indicate a perfect fit and cutoff values ≥ .95 are indicative of a good fit. At minimum, factor loadings for items should be >0.32 (Tabachnick and Fidell, 2012), with ≥ 0.4 preferred (Santor et al., 2011). Costello and Osborne (2005) recommended that factors with five or more strongly loading items (0.5 or greater) are most desirable and indicative of solid factor.

3. Results

3.1. Participants

A total of 305 individuals consented to participate and completed the first visit, representing 154 males (50.5%) and 151 females

Table 5
Confirmatory factor analysis goodness of fit indices for BIS-11T, BIS-15T, and BIS-Brief-T.

Goodness of fit statistics	Recommended cut offs (Hu and Bentler, 1999)	BIS-11T Patton 1st order factor	Patton 2nd order factor	Haden & Shiva 2 factor	Reise et al. 2 factor	BIS-15T	BIS-BriefT
SRMR	≤0.08	0.104	0.095	0.094	0.089	0.072	0.085
RMSEA	≤0.06	0.085	0.094	0.096	0.084	0.076	0.150
CFI	≥0.95	0.681	0.602	0.705	0.686	0.861	0.810
TLI	≥0.95	0.645	0.570	0.676	0.660	0.832	0.734

Goodness of fit was triangulated using four metrics: SRMR (standard root mean square residual; (Joreskog and Sorbom, 1988), RMSEA (root mean square error of approximation; (Steiger, 2007), CFI (comparative fit index; (Bentler, 1990) and TLI (Tucker-Lewis index; (Tucker and Lewis, 1973). SRMR and RMSEA values of 0 are indicative of a perfect fit, whereas CFI and TLI values of 1 suggest a perfect fit. Only BIS-15T data met recommended SRMR cut points, though remaining metrics exceeded recommended values.

Table 6
Standardized factor loadings for confirmatory factor analysis of BIS-11-T. Factor structures tested include Patton et al.'s 1st and 2nd order factor structures (1995), Haden & Shiva's 24-item 2 factor structure (2008), and Reise et al.'s 2 factor structure (2013). Factor loadings for items should be >0.32 (Tabachnick and Fidell, 2012), though ≥0.4 is preferred (Santor et al., 2011) and >0.5 is most desirable (Costello and Osborne, 2005).

Item	Scored	Patton et al., 1995											Haden & Shiva, 2008			Reise et al., 2013		
		Patton 1st order factor Loadings							Patton 2nd order factor loadings				Haden & Shiva factor loadings			Reise factor loadings		
		Factor	SC	M	A	CI	CC	P	Factor	A	M	NP	Factor	M	NP	Factor	Factor 1 (F1)	Factor 2 (F2)
1. I plan tasks carefully.	RS	SC	0.775	0.067	0.255	0.055	−0.013	−0.091	NP	0.342	0.132	0.765	NP	−0.004	0.775	F1	0.767	0.068
2. I do things without thinking.	+	M	−0.126	0.595	0.134	−0.272	−0.110	0.102	M	0.048	0.627	−0.047	M	0.577	−0.087	F2	−0.074	0.597
3. I make-up my mind quickly.	+	M	0.271	0.499	−0.241	−0.342	0.093	−0.269	M	−0.632	0.443	0.362	NP	0.454	−0.105	–	–	–
4. I am happy-go-lucky.	+	M	−0.228	0.545	0.211	−0.008	−0.097	0.200	M	0.356	0.580	−0.214	–	–	–	–	–	–
5. I don't "pay attention."	+	A	−0.345	0.275	0.388	0.240	0.138	−0.107	A	0.465	0.253	0.262	–	–	–	F2	−0.022	0.511
6. I have "racing" thoughts.	+	CI	0.216	−0.263	−0.210	0.569	0.156	−0.192	A	0.331	0.686	0.864	M	0.463	0.213	F2	0.203	0.422
7. I plan trips well ahead of time.	RS	SC	0.600	0.043	0.319	0.020	−0.070	0.003	NP	0.057	0.015	0.581	NP	−0.033	0.584	F1	0.581	−0.048
8. I am self-controlled.	RS	SC	0.531	0.129	−0.802	0.131	0.201	−0.373	NP	0.116	0.103	0.512	NP	0.039	0.556	F1	0.549	0.069
9. I concentrate easily.	RS	A	−0.088	0.176	−0.694	0.163	0.097	−0.188	A	−0.585	0.796	1.052	NP	0.016	0.669	F1	0.658	0.066
10. I save regularly.	RS	CC	0.288	−0.247	−0.346	−0.270	0.164	−0.305	NP	−0.211	−0.084	0.330	NP	−0.106	0.333	F1	0.350	0.010
11. I "squirm" at plays or lectures.	+	A	0.398	0.143	0.326	0.116	0.084	−0.572	A	0.345	0.105	0.375	M	0.361	−0.015	F2	0.021	0.382
12. I am a careful thinker.	RS	SC	0.778	−0.012	−0.045	−0.002	−0.014	0.115	NP	0.129	0.058	0.780	NP	−0.070	0.776	F1	0.776	−0.012
13. I plan for job security.	RS	SC	0.655	0.083	0.106	0.040	0.016	−0.284	NP	0.200	0.089	0.644	NP	−0.011	0.662	F1	0.663	0.059
14. I say things without thinking.	+	SC	−0.523	0.380	0.191	0.294	0.060	−0.641	NP	0.926	0.456	−0.539	M	0.658	−0.086	F2	−0.056	0.684
15. I like to think about complex problems.	RS	CC	−0.084	0.054	0.102	0.089	0.723	0.119	NP	0.440	0.223	0.258	NP	0.207	0.307	F1	0.294	0.225
16. I change jobs.	+	P	−0.263	0.142	0.132	0.145	0.065	0.051	M	−0.178	0.199	0.104	–	–	–	F2	0.040	0.173
17. I act "on impulse."	+	M	0.163	0.614	−0.154	−0.019	0.061	−0.140	M	−0.435	0.568	0.255	M	0.534	0.112	F2	0.102	0.489
18. I get easily bored when solving thought problems.	+	CC	−0.265	0.302	0.337	0.356	−0.201	0.282	NP	0.694	0.290	−0.416	M	0.495	−0.060	F1	−0.386	0.324
19. I act on the spur of the moment.	+	M	−0.125	0.654	0.130	−0.022	−0.059	0.107	M	0.118	0.673	−0.058	M	0.669	−0.049	F2	−0.019	0.694
20. I am a steady thinker.	RS	A	0.150	0.145	−0.638	0.125	0.105	−0.430	A	−0.536	0.552	0.809	NP	0.040	0.633	F1	0.624	0.078
21. I change residences.	+	P	−0.227	0.150	0.148	0.183	0.093	0.098	M	−0.112	0.227	0.084	M	0.218	0.041	F2	0.053	0.221
22. I buy things on impulse.	+	M	0.180	0.681	−0.195	0.327	0.156	−0.153	M	−0.371	0.617	0.237	M	0.640	0.156	F1	−0.325	0.603
23. I can only think about one thing at a time.	+	P	−0.041	0.049	0.249	0.013	−0.118	0.052	M	−0.003	0.092	0.007	–	–	–	F1	−0.049	0.119
24. I change hobbies.	+	CI	0.065	−0.035	−0.057	0.240	0.052	−0.070	A	0.151	0.244	0.350	–	–	–	F2	0.132	0.230
25. I spend or charge more than I earn.	+	M	−0.166	0.462	0.140	0.408	−0.068	0.190	M	0.448	0.454	−0.266	M	0.476	−0.141	F1	−0.419	0.291
26. I often have extraneous thoughts when thinking.	+	CI	−0.308	0.402	0.292	0.775	−0.218	0.272	A	0.604	0.525	0.570	M	0.706	0.007	F2	−0.077	0.643
27. I am more interested in the present than the future.	+	CC	−0.017	0.077	0.014	0.056	0.066	−0.007	NP	0.323	0.197	0.007	–	–	–	F1	0.014	0.095
28. I am restless at the theater or lectures.	+	A	0.176	0.151	0.348	0.157	0.150	−0.411	A	0.380	0.062	0.321	M	0.396	−0.036	F2	−0.005	0.421
29. I like puzzles.	RS	CC	−0.133	0.104	0.175	0.091	0.714	0.108	NP	0.546	0.277	0.238	NP	0.243	0.298	F1	0.285	0.282
30. I am future oriented	RS	P	−0.188	0.115	0.167	0.122	0.367	−0.642	M	−0.897	−0.353	0.539	NP	0.043	0.588	F1	0.578	0.078

'RS' denotes reverse scored items while '+' describes items that were positively scored. The BIS-11 was published (Patton et al., 1995) with six first order subscales (Self-Control [SC, 6 items), Motor [M, 7 items], Attention [A, 5 items], Cognitive Instability [CI, 3 items], Cognitive Complexity [CC, 5 items] and Perseverance [P, 4 items] and three second order subscales (Attentional [A, 8 items], Motor [M, 11 items], and Non-Planning [NP, 11 items]. Using absolute value, a total of 23 out of 30 1st and 2nd order factor items exceeded the minimal 0.32 cutoff (77%), Haden and Shiva (2008) describe a 24-item 2 factor structure comprising Motor (M, 12 items) and Non-Planning (NP, 12 items) factor structures, with 20 out of 24 items exceeding 0.32 in the current study (83%). Reise et al. (2013) describe a 28-item, 2 factor structure (F1 [16 items] and F2 [12 items]), where 21 out of 28 items exceed 0.32 (75%).

Table 7
Standardized factor loadings for confirmatory factor analysis of BIS-15-T and BIS-BriefT.

Item	Scored	BIS-15T factor loadings				BIS-BriefT One factor loading
		Factor	Attention	Motor	Non-planning	
1. I plan tasks carefully.	RS	NP	−0.012	−0.017	0.669	0.742
2. I do things without thinking.	+	M	0.157	0.521	−0.179	−0.500
3. I don't "pay attention."	+	A	0.439	0.237	0.029	−0.413
4. I concentrate easily.	RS	A	−0.551	0.354	0.369	0.626
5. I save regularly.	RS	NP	−0.048	−0.005	0.389	–
6. I "squirm" at plays or lectures.	+	A	0.461	0.047	0.180	–
7. I am a careful thinker.	RS	NP	−0.117	−0.081	0.692	0.772
8. I plan for job security.	RS	NP	0.201	0.133	0.693	–
9. I say things without thinking.	+	M*	0.235	0.661	−0.195	−0.569
10. I act "on impulse."	+	M	−0.165	0.671	0.144	–
11. I get easily bored when solving thought problems.	+	A*	0.642	0.073	−0.011	–
12. I act on the spur of the moment.	+	M	−0.285	0.485	0.264	−0.555
13. I buy things on impulse.	+	M	−0.050	0.657	0.064	–
14. I am restless at lectures or talks.^	+	A	0.548	0.003	0.178	–
15. I am future oriented^	RS	NP*	−0.041	−0.023	0.654	–
BIS-Brief only: I am self-controlled	RS	–	–	–	–	0.535

Items reverse scored are denoted by 'RS' (reverse scored) whereas '+' denotes items positively scored. ^Two items in BIS-15 were previously reworded (Spinella, 2007), with the re-wording used for translations in the present study. Specifically, BIS-11's "I am restless at the theater or lectures" was previously changed to "I am restless at lectures or talks" and "I am future-oriented" was previously reworded to "I plan for the future." This item phrasing is consistent with wording found in the BIS-11a, an earlier version of the BIS-11 instrument (Lijffijt, 2011). *BIS-15 factors were computed as previously reported (Spinella, 2007), with three items denoted by asterisks applying a different factor structure than reported in BIS-11, but consistent with the BIS-11a factor structure (Lijffijt, 2011).

(49.9%). The mean age of participants was 32.6 + 9.2 years. As described in Table 1, most participants had a bachelor's degree (73.4%) or higher (6.6%), though 57 participants (18.7%) had lower education than an undergraduate degree. A total of 260 participants (85.2%) returned for Visit 2.

3.2. Descriptive statistics

Visit 1 total scores were distributed across a wide range for all three BIS instruments (Fig. 1). Statistical tests indicate Visit 1 scores were normally distributed for BIS-11T and BIS-15T ($p \geq 0.05$; Table 2) while BIS-Brief T scores were not normally distributed on the S-K Test ($p = 0.034$) but satisfied criteria for normally distributed data on the other two tests.

3.3. Internal consistency and test-retest reliability

Instruments' total scores showed excellent internal consistency, with Cronbach's alpha coefficients above 0.80 for all translated instruments at Visit 1: BIS-11T ($\alpha = 0.86$), BIS-15T ($\alpha = 0.81$), BIS-Brief-T ($\alpha = 0.81$; Table 3). Internal consistency for first order constructs originally described by Patton (Patton et al., 1995; Stanford et al., 2009) ranged from $\alpha = 0.20$–0.80 while second order constructs ranged from $\alpha = 0.67$–0.73. More recent factor structures, such as those described by Haden & Shiva (2008) and Reise et al. (2013), were also tested in the current study with Cronsbach's alpha ($\alpha = 0.86$ and $\alpha = 0.85$, respectively, for total scores). BIS-15T applied Spinella's 3 factor structure (2007), with $\alpha = 0.66$–0.74.

All Thai BIS instruments correlated with each other at the time of first visit (Table 4). A total of 260 participants returned two weeks later for retest, with correlations greater than 0.80 observed between the first and second visit for all three instruments: BIS 11-T ($r = 0.84$, $p < 0.001$), BIS-15T ($r = 0.81$, $p < 0.001$), and BIS-Brief-T ($r = 0.81$, $p < 0.001$).

3.4. Construct validity

Four factor structures were tested for BIS-11T (Patton et al., 1995; Haden and Shiva, 2008; Reise et al., 2013), though no metrics met recommended goodness of fit cutoffs (SRMR ≤ 0.08; RMSEA ≤ 0.06, CFI ≥ 0.95 and TLI ≥ 0.95; Table 5). Absolute values of factor loadings were examined for BIS-11T, with Patton's 1st and 2nd order factor loading having 7 items less than 0.32 and 23 items (77%) between 0.32–0.78 (Table 6). Using a higher cutoff (Costello and Osborne, 2005), a total of 18 1st order items (60%) and 14 2nd order items (47%) exceeded 0.5. Of the 24 items included in Haden & Shiva's 2 factor structure, 20 were above 0.32 (83%) and 14 (58%) exceeded 0.5. Reise et al.'s 28 item, 2 factor structure included 21 items (75%) above 0.32 with 13 items (46%) exceeding 0.5.

In contrast, the three factors proposed in BIS-15 were found to fit better, as SRMR = 0.072 met recommended cutoffs. However, RMSEA, CFI, and TLI were outside recommended ranges, indicating that some of the data did not fully fit. Factor loading of BIS-15T showed all items between 0.32–0.693 (100%; Table 7), with 11 of 15 items exceeding 0.5 (73%). Of the 4 items below 0.5, 3 items exceeded 0.4 and 1 item was 0.389.

The BIS Brief-T did not meet any goodness of fit metrics despite all 8 items exceeding factor loading cutoffs of 0.32, with 7 out of 8 exceeding 0.5 (88%; Table 7).

4. Discussion

The utility of BIS instrument has been used widely to assess impulsivity. The purpose of the current study was to adapt the BIS instruments (BIS-11, BIS-15, and BIS-Brief) for utilization with Thai-speaking populations. The findings of this study suggest that the BIS instruments can distinguish a broad range of impulsivity scores in a Thai-speaking population. Statistical analyses provide evidence for high internal reliability ($\alpha \geq 0.81$) and test-retest consistency ($r \geq 0.81$) for all three questionnaires (BIS-11T, BIS-15T, BIS-brief T). Data were normally distributed for BIS-11T and BIS-15T, though skewed for the BIS-Brief-T. As the BIS-Brief-T (8 items) was computed post-hoc from BIS-11T data (30 items), it is possible that the shorter survey may have amplified non-significant differences in normality observed with BIS-11T (Shapiro Wilk $p = 0.05$; Table 2). Further work will be needed to understand how BIS-Brief-T scores are distributed for both the general population and clinically-relevant subjects.

The BIS total score is increasingly reported in studies for comparative purposes, though researchers recommend that the factor structure should also be reported to enable individual contributions of factors to be examined (Stanford et al., 2009). In the current study, confirmatory factor analysis was used to examine BIS-11T factor structures proposed

by Patton et al. (1995), Haden and Shiva (2008), and Reise et al. (2013). Haden & Shiva's 24 item, 2 factor model had the highest internal reliability, with excellent Cronsbach's alpha coefficients for both total score (α = 86) and subscale scores (both subscales' α = 0.81). In addition, Haden & Shiva's factor structure had highest item loading for BIS-11T (i.e., 20 of the 24 items (83%) were above minimal 0.32 cutoff (Tabachnick and Fidell, 2012) and 14 items (58%) exceeded the more rigorous 0.5 cutoff (Costello and Osborne, 2005). However, the factor structure proposed by Reise et al. (2013) also fit the data. Despite slightly lower Cronsbach's alpha values (α = 0.85 for total; α = 0.77–0.79 subscales) and item loading (e.g., 21 of 28 items (75%) above 0.32), the Reise model's goodness of fit statistics were closest to recommended cutpoints (Hu and Bentler, 1999). It is important to note that none of the BIS-11T models met any of the goodness of fit recommended cutoffs (Table 5). The Patton 1st order factor structure performed worst, with lowest internal reliability observed for the 'Perseverance' factor (α = 0.2). Two of its four questions with low item loading, "I change jobs" (0.051) and "I change residences" (0.098) are highly related to income and socioeconomics. While Thailand was reclassified as an upper-middle income country in 2011 by the World Bank and poverty decreased from 67% in 1986 to 7.1% in 2015, approximately 94% of Thai citizens still lived within 20% of the poverty line in 2014 (World Bank, 2018). As the mean age of participants in this study was 32.6 years, many may have experienced poverty as youth. Socioeconomics was not measured in the current study, though prior research found higher income to be associated with lower delay discounting (i.e. choosing sooner, smaller rewards) and lower non-planning impulsiveness (de Wit et al., 2007; Reimers et al., 2009). BIS-11T's question "I am more interested in the present than the future" (Perseverance subscale) also had low item loading across all factor structures that included the question (0.007–0.014). Of note, the Haden and Shiva factor structure excludes this question. Our Thai colleagues report that looking at the present (rather than future) is not considered universally admirable across Asian cultures. Consistent with this notion, "I am future oriented" (BIS-11T; Perseverance subscale) showed strong item loading (−0.642) as did companion wording used in the BIS-15T ("I plan for the future"; α = 0.654).

The BIS-15T is a shorter instrument than BIS-11 (15 items vs 30 items) and was the only instrument to meet goodness of fit recommended cutoffs for SRMR (Table 5). While BIS-15T did not meet other fit recommendations (e.g., RMSEA, CFI, and TLI), suggesting that some of the data did not fully fit, its metrics were closest to recommended cutoffs compared to the other instruments, BIS-11 or BIS-Brief-T. Goodness of fit indices require large samples to discern good from poor predictions (Prudon, 2015), therefore, this study offers preliminary evidence for how these scales may perform in larger Thai population, though further testing is needed.

The BIS-15T 3 factor structure was supported (Spinella, 2007), with all items between 0.32–0.693 (100%; Table 7), and 11 of 15 items exceeding 0.5 (73%). Of the 4 items below 0.5, 3 items exceeded 0.4 and 1 item was 0.389. The wording and factor structure of the BIS-15T differs slightly from the BIS-11 and is consistent with the BIS-11a, an earlier version of the instrument (Lijffijt, 2011). While these differences could be seen as a negative, all of the item loadings were larger in magnitude for the BIS-15T when compared to analogous questions in the BIS-11T, which differed in phrasing or factor structure. For example, item loading for "I get easily bored when solving thought problems" moved from −0.416 (BIS-11a; NP) to α = 0.642 (BIS-15, A). Moreover, Cronsbach's alpha coefficients for Attention, Motor, and Non-Planning subscales were largely consistent between BIS-11T and BIS-15T despite different number of items, phrasing, and factor structures (e.g., 0.67 and 0.66 for A; 0.71 and 0.73 for M; and 0.73 and 0.74 for NP, respectively; Table 3). The findings of this study are consistent with original factor loadings published in English (Spinella, 2007) as well as translated versions in Spanish (Orozco-Cabal et al., 2010) and French (Rousselle and Vigneau, 2016). In addition to excellent internal consistency (α = 0.81), the BIS-15T data showed evidence of strong test-re-test reliability over a two week period, as measured by Pearson correlation coefficient (r = 0.81).

This study had good data validation using double entry mechanism that should have minimized errors at data entry stage. This study's population was confined to clients who came for an annual health check-up at three private hospitals in Bangkok. Therefore, subject recruitment was not representative of general Thai population. For example, 80% of our study population had attained a Bachelor's degree or higher, compared with 14.8% nationally in 2016 (IndexMundi, 2016). Higher educational attainment has been associated with lower impulsivity (Reimers et al., 2009); thus, greater variation in impulsivity levels would be expected in a larger, Thai national sample. Due to using the annual health check-up for recruitment, some subjects did not return for the second visit (15%), as annual checkup required only one visit unless a serious illness was found that required further follow up. This led to some missing data, which resulted in limitations of data interpretation. The present study was also conducted using a non-clinical population, though a broad range of observed scores suggest utility of these instruments across a spectrum of use cases. It remains unclear whether the Thai versions of the BIS would be able to predictively discriminate between clinically impulsive subjects and non-impulsive subjects. It also remains unclear how impulsivity in a Thai population relates to healthy behaviors and meeting physical activity recommendations, which might contribute to better design of health intervention programs. These are areas for future work now that BIS instruments are available in Thai.

In summary, the BIS instruments are able to measure a spectrum of impulsivity scores in a Thai-speaking population. While our data support use of BIS-15T, in particular, based on its internal reliability, test-retest consistency, item loading, and partial meeting of recommendations for goodness of fit, future work would be needed to support reliability and validity testing of these tools, such as measurement invariance within subgroups of interest (e.g., income, sex, educational attainment), convergent/discriminant validity, concurrent or predictive validity with clinical patients (e.g. substance use), as well as incremental validity. This study offers strong preliminary evidence that the BIS instruments can be used with Thai-speaking adults for this future work.

Disclaimers and disclosure statement

The authors have no conflict of interest to report.

Acknowledgments

This study was supported by joint Research and Development funding from Bangkok Dusit Medical Services (BDMS) of Thailand and from Oregon Health & Science University of Portland, Oregon (USA). The authors also would like to express appreciation to staff of Bangkok Hospital Headquarters, Bangkok Hospital Prapaedang, Phayathai 2 Hospital for data collection. We also grateful for kind support of International Affiliation Center (IAC) of BDMS for their coordination among OHSU and BDMS personnel. Finally, we express our sincere thanks to Dr. Pravich Tanyasittisuntorn on his technical support from the inception of this study, during project implementation, as well as data analysis, interpretation and manuscript preparation.

Appendix

Table A1 and Table B1.

Table A1
Comparison of descriptive statistics for translated versions of the BIS instruments.

Instrument	Sample	Internal consistency (Cronsbach's Alpha)	Test-Retest (Time; r)	Factor structure explored	Predictive validity
BIS-11					
Original English (Patton et al., 1995)	733 total, including 412 college students, 248 psychiatric inpatients, and 73 male prison inmates	0.82 for college students; 0.79 for substance use patients, 0.83 for psychiatric patients, 0.80 for prison inmates	Not reported	PCA; 6 first order; 3 s order factors	Higher scores among prison inmates compared to other groups
English (Stanford et al., 2009)	1577 adults, age 17–45 years	0.83 (total); Subscales 0.61(A) – 0.72 (NP).	153 retested at one month; 0.83	Not reported beyond Cronsbach's alpha	Higher impulsivity among shoplifters (OR = 2.54) and self-mutilators (OR = 2.23)
German, adults (Preuss et al., 2008; *article in German*)	810 control adults (median age 47.3 years); 211 clinically-relevant adults	0.69 (total)	Not reported	CFA does not support Patton's 1st order (6 factor) structure	Control adults had significantly lower total scores than 114 alcohol abusers, 57 suicidal patients, or 40 borderline personality patients
German, adolescents (Hartmann et al., 2011)	659 adolescents aged 10–20 years	0.74 (total); Subscales 0.30 (M) −74 (	98 were retested after 6 months; 0.66	Exploratory factor analysis	Total scale correlated ($r = 0.51$) with impulsiveness portion of Inventory for the Assessment of Impulsiveness, Venturesomeness, and Empathy (IVE) scale
Italian (Fossati et al., 2001)	763 college students	0.79 (total)	2 months; 0.89	PCA; supported use of total score	Correlated with aggression, ADHD, binge eating, alcohol use, and smoking
Japanese (Someya et al., 2001)	450 college students and adults	0.80 (total); subscales 0.60 (A) – 0.65 (NP)	4 months, 0.71 (total)	CFA, similar factor structure as English	Not reported
Portuguese, Brazilian (Malloy-Diniz et al., 2015)	3053 adults from 8 Brazilian states, aged 18–84 years	0.79 (total)	Not reported	Regression analyses show 2 factor structure	Not reported
Arabic (Ellouze et al., 2013)	134 adults, aged 20–49	0.78 (total); Subscales 0.61 (NP) – 0.72 (M)	Not reported	EFA identified 3 factors	Not reported
Chinese (Yao et al., 2007)	396 urban high school students	0.80	1 month; 0.70	CFA; 6 first order factors, with 2 s order factors	Risky Behavior Questionnaire-Adolescent; Rutgers Alcohol Problem Index
Norwegian (Lindstrøm et al., 2017)	110 adults (20–85 years), including 47 healthy controls, 43 Parkinson's patients, and 20 headache patients	0.68 (total); 0.60 for healthy control group	1 h later in a sub-sample of 27 patients, 0.65 for total score	PCA, CFA; best fit with Reise 2 factor model	Not reported
Hebrew (Glicksohn and Nahari, 2007)	232 participants, aged 20–34	0.78	Not reported	EFA, did not match to 3 factor structure	Significant correlation between impulsivity and cigarettes smoked per day
Estonian (Paaver et al., 2007)	683 subjects with mean age 19 ± 8 years of age ranging from 14–66	0.80 (27 items used)	Not reported	Total score used	Interaction with two markers of lower serotonergic capacity, 5-HTTLPR S allele and low platelet MAO activity

(*continued on next page*)

Table A1 (*continued*)

Instrument	Sample	Internal consistency (Cronsbach's Alpha)	Test-Retest (Time; r)	Factor structure explored	Predictive validity
Dutch (Goudriaan et al., 2008)	46 adult outpatient pathological gamblers	0.81	Retest administered, but statistics not reported	Not reported	No correlation with relapse among pathological gamblers completing treatment
Spanish (Martinez-Loredo et al., 2015)	1183 adolescents aged 12–14 years	0.87	Not reported	Kaiser-Meyer-Olkin Index value was 0.87 and supported two factor structure	Good capacity for identifying substance use, binge drinking and problem drinking (sensitivity = 67.3–75%; specificity = 83.4–85.4%)
Thai (this study)	305 non-clinical adults	0.86	2 weeks in 260 participants, 0.84	CFA; 3 factor structure not supported	Not reported
BIS-15					
Original English (Spinella, 2007)	700 participants, age 15–89	0.81 (total)	Not reported	PCA with varimax rotation; 3 factor structure	Correlates with Frontal Systems Behavior Scale (FrSBe)
German (Meule et al., 2011; Meule et al., 2015)	133 female college students	0.74 (total (scores 0.60–0.78)	6 months, r = 0.79	Not reported	Correlations to other measures in (Meule, 2013)
Spanish (Orozco-Cabal et al., 2010)	447 subjects, adults	0.79 (total)	2 weeks, 0.80, for 20 participants	PCA; 3 factor structure supported	Higher BIS-15S scores among subjects with substance-related disorders, bipolar disorders, and bulimia nervosa/binge eating.
French (Rousselle and Vigneau, 2016)	366 participants; 322 participants across 2 studies	0.71 and 0.81 for total score in the paper's two studies	0.84, 1 week later 70 people	PCA and CFA, 3 factor structure supported	Used big five inventory for comparison, correlated with anxiety, neurosis, and extraversion
Thai (this study)	305 participants	0.81	0.81 over 2 weeks, among 260 participants	CFA, 3 factor structure supported	Not reported
BIS-Brief					
English (Steinberg et al., 2013)	1178 college students	0.78	Not reported	Confirmatory multidimensional IRT approach to identify 8 items	Higher BIS Brief scores among diagnosed borderline personality disorder patients, domestic violence adults, and with measures of aggression in an inpatient sample of young adults and adolescents.
Thai (this study)	305 participants	0.84	0.81 over 2 weeks, among 260 participants	Total score used; CFA applied to other BIS scales	Not reported

Table B1
Thai translations for items and responses of the BIS-T instruments.

Item	Thai Translation	BIS-11	BIS-15	BIS-Brief
1. I plan tasks carefully.	ฉันวางแผนงานอย่างรอบคอบ	Y	Y	Y
2. I do things without thinking.	ฉันทำสิ่งต่างๆ โดยไม่ได้คิดล่วงหน้า	Y	Y	Y
3. I make-up my mind quickly.	ฉันเป็นคนตัดสินใจรวดเร็ว	Y	–	–
4. I am happy-go-lucky.	ฉันเป็นคนปล่อยตามสบายไม่มีแบบแผน	Y	–	–
5. I don't "pay attention."	ฉันเป็นคนไม่ใส่ใจ	Y	Y	Y
6. I have "racing" thoughts.	ฉันคิดหลายเรื่องพร้อมกัน	Y	–	–
7. I plan trips well ahead of time.	ฉันวางแผนก่อนการเดินทางล่วงหน้าเป็นเวลานาน	Y	–	–
8. I am self-controlled.	ฉันควบคุมตัวเองได้	Y	–	Y
9. I concentrate easily.	ฉันมีสมาธิได้ง่าย	Y	Y	Y
10. I save regularly.	ฉันเก็บออมอยู่เรื่อยๆ	Y	Y	–
11. I "squirm" at plays or lectures.	ฉันชอบขยับตัวไปมาระหว่างดูละครเวทีหรือฟังบรรยาย	Y	Y	–
12. I am a careful thinker.	ฉันเป็นคนที่คิดอย่างรอบคอบ	Y	Y	Y
13. I plan for job security.	ฉันวางแผนความมั่นคงในหน้าที่การงาน	Y	Y	–
14. I say things without thinking.	ฉันพูดถึงสิ่งต่างๆ โดยไม่ได้คิด	Y	Y	Y
15. I like to think about complex problems.	ฉันชอบที่จะคิดเกี่ยวกับปัญหาที่ซับซ้อน	Y	–	–
16. I change jobs.	ฉันเปลี่ยนงาน	Y	–	–
17. I act "on impulse."	ฉันตัดสินใจรวดเร็วกระทันหัน	Y	Y	–
18. I get easily bored when solving thought problems.	ฉันรู้สึกเบื่อง่าย ในขณะที่กำลังครุ่นคิดแก้ไขปัญหา	Y	Y	–
19. I act on the spur of the moment.	ฉันลงมือทำโดยทันทีทันใด	Y	Y	Y
20. I am a steady thinker.	ฉันเป็นคนที่ใช้ความคิดสม่ำเสมอ	Y	–	–
21. I change residences.	ฉันเปลี่ยนที่พักอาศัย	Y	–	–
22. I buy things on impulse.	ฉันซื้อของโดยใช้แรงดลใจ	Y	Y	–
23. I can only think about one thing at a time.	ฉันสามารถคิดได้ทีละเรื่องเท่านั้น	Y	–	–
24. I change hobbies.	ฉันเปลี่ยนงานอดิเรก	Y	–	–
25. I spend or charge more than I earn.	ฉันใช้จ่ายมากกว่ารายรับ	Y	–	–
26. I often have extraneous thoughts when thinking.	ฉันชอบคิดถึงเรื่องอื่นๆ ที่ไม่เกี่ยวข้องกับเรื่องที่กำลังครุ่นคิดอยู่บ่อยครั้ง	Y	–	–
27. I am more interested in the present than the future.	ฉันสนใจปัจจุบันมากกว่าอนาคต	Y	–	–
28. I am restless at the theater or lectures.	ฉันรู้สึกกระสับกระส่ายระหว่างดูละครเวทีหรือฟังบรรยาย	Y	Yˆ	–
29. I like puzzles.	ฉันชอบการแก้เกมปริศนา	Y	–	–
30. I am future oriented	ฉันคำนึงถึงผลของอนาคต	Y	Yˆ	–
Response options				
1. Rarely/ Never	น้อยครั้ง / ไม่เคย	Y	Y	Y
2. Occasionally	บางครั้ง	Y	Y	Y
3. Often	บ่อยครั้ง	Y	Y	Y
4. Almost always/ Always	ทุกครั้ง / เกือบทุกครั้ง	Y	Y	Y
BIS-15 wording variationsˆ				
I plan for the future	ฉันคำนึงถึงผลของอนาคต		Yˆ	
I am restless at lectures or talks	ฉันรู้สึกกระสับกระส่ายระหว่างดูละครเวทีหรือฟังบรรยาย		Yˆ	
Title and Instructions				
Impulsivity Scale	เกณฑ์วัดการตอบสนองต่อสิ่งเร้าอย่างฉับพลันทันที (Impulsivity)	Y	Y	Y
Read each statement and mark one response for each question. Do not spend too much time on any statement. Answer quickly and honestly.	อ่านข้อความแต่ละข้อและทำเครื่องหมายเลือกคำตอบสำหรับคำถามแต่ละข้อ อย่าใช้เวลามากเกินไปในข้อความใดข้อความหนึ่ง ตอบอย่างรวดเร็วและตรงตามความจริง	Y	Y	Y

Note: ˆTwo items in BIS-15 were previously reworded (Spinella, 2007), with the re-wording used for translations in the present study. Specifically, BIS-11's "I am restless at the theater or lectures" was previously changed to "I am restless at lectures or talks" and "I am future-oriented" was previously reworded to "I plan for the future." This item phrasing is consistent with wording found in the BIS-11a, an earlier version of the BIS-11 instrument (Lijffijt, 2011). Factor structures also differ between the instruments, with structures outlined in Tables 6 and 7 of the manuscript.

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