



Factor structure validation, psychometric evaluation and measurement invariance testing of the Brief Sensation Seeking Scale-Chinese (BSSS-C) in Indian adolescents



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ABSTRACT

Background: Self-report measures of sensation seeking though commonly used in research have not undergone factor structure or psychometric validation in Indian adolescents. The Brief Sensation Seeking Scale - Chinese (BSSS-C; Chen et al., 2013) is a less culture specific tool with excellent psychometric properties and presents a suitable option for use with Indian adolescents.

Aim: The present study aims to validate the factor structure, evaluate the psychometric properties, and examine the gender invariance of the BSSS-C in Indian adolescents.

Methods: A community sample of adolescent, $n = 2079$, with mean age 17 years ($SD = 1.71$) completed the BSSS-C, the BIS/BAS, and the Adolescent Risky Behaviour scales.

Results: The four factor structure of the BSSS-C exhibited good to excellent model fit, acceptable internal consistency reliability ($\alpha = 0.77$) and, adequate construct as well as concurrent validity in Indian adolescents. Invariance testing revealed that the factor configuration and factor loadings of the BSSS-C were equivalent across the gender. Three of the four BSSS-C latent factors were amenable for mean comparisons across the gender.

Conclusion: BSSS-C is a reliable measure of the four dimensional model of sensation seeking in Indian adolescents. The gender differences in the BSSS-C factors are attributable to real differences in sensation seeking construct between male and female adolescents.

1. Introduction

Sensation seeking is a relatively stable personality disposition that is characterized by seeking of varied, novel, complex, and intense sensations and experiences (Zuckerman, 1994). Additionally, it entails the readiness to seek such sensations and experiences despite inevitable physical, social, legal, and financial risks (Zuckerman, 1994). A spurt in sensation seeking is observed during adolescence (Romer, 2010). Sensation seeking may broaden the repertoire of healthy exploratory behaviours in adolescents, but it does also push them towards experimenting with problematic activities called risk taking behaviours (Zuckerman, 2015). Sensation seeking has been found to predict both the early debut and level of involvement in risky behaviours such as smoking, alcohol consumption, drug use, unsafe sexual activities, unhealthy eating, and reckless driving, that endanger adolescent's health and wellbeing in the short or the long run (Lydon Staley and Geier, 2018; de Leeuw et al., 2011; MacPherson et al., 2010; Donohew et al.,

1999; Leeman et al., 2014; Donohew et al., 2000; Laghi et al., 2015; Jonah, 1997a,b). In light of these implications of sensation seeking for adolescent development and wellbeing, it is imperative to have a well validated tool for the assessment of sensation seeking in adolescents.

Sensation seeking has been widely assessed with a 40 item self-report measure called the sensation seeking scale form-V (SSS-V; Zuckerman et al., 1978). More than two decades after its development, a shorter 8 item version called the brief sensation seeking scale (BSSS-8; Hoyle et al., 2002) was developed for use with adolescents in settings that require a quick but comprehensive assessment of sensation seeking. The BSSS-8 has recently undergone a cultural adaptation for use with Chinese population and is known as the Brief Sensation Seeking Scale-Chinese (BSSS-C; Chen et al., 2013). The BSSS- 8 items were significantly revised by Chen et al. (2013) by replacing their culture specific content with words or phrases that were appropriate for assessing sensation seeking tendencies among individuals of a developing nation like China. Unlike the BSSS-8, the revised item content of

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the BSSS-C did not refer to modes or opportunities of sensation seeking that are largely inaccessible or not so prevalent among individuals of developing nations. Additionally, the authors of the BSSS-C attempted to ensure that content of the items is culturally compatible in terms of their interpretation. The resultant BSSS-C, therefore, is less culture specific, suitable for populations of developing nations and cross national research. Given the considerable similarity between neighbouring Indian and Chinese societies in the economic and cultural aspects, we choose the BSSS-C instead of the BSSS-8 for validation in Indian adolescents. Therefore, the present study intends to replicate the original factor structure of the BSSS-C and then validate the same in Indian adolescents. This will be followed by the evaluation of its construct validity, concurrent validity, and internal consistency reliability in Indian adolescents.

To the best of our knowledge, the BSSS-C has not been examined for measurement invariance across the gender of adolescents. A meaningful and reliable between-groups comparison (for example, males versus females) of latent factors of any survey questionnaire requires the establishment of measurement invariance for that questionnaire. Establishing measurement invariance becomes particularly important when assessment tools assess gender sensitive psychological constructs such as sensation seeking. Literature reveals that males mostly score higher on overall sensation seeking, novelty and intensity seeking, thrill and adventure seeking, disinhibition, and boredom susceptibility (Zuckerman et al., 1978; Arnett, 1994; Cross et al., 2013). Despite the strong evidence about the existence of gender differences in sensation seeking, one might suspect these differences on sensation seeking questionnaires to arise from potential non-invariance of the scale items across the gender. In order to address this doubt, the present study has attempted to examine the measurement invariance to find: a) Whether gender differences in sensation seeking on the BSSS -C (if any) are reflective of true differences in the underlying sensation seeking construct between males and females; b) Whether or not the comparison of mean scores on the BSSS-C factors between male and female adolescents is justifiable? Finally, the study has also examined if the BSSS-C factor scores, and the total sensation seeking score, are influenced by the age and gender interactions.

2. Methods

2.1. Participants

A large community sample of adolescents, $n = 2079$, in the age range of 14–20 years, who were attending schools and colleges were recruited for the present study. The mean age of the participating adolescents was 17 years ($SD = 1.71$). Approximately 49% of the participants were females, and the rest 51% were males. Table 1 further summarises the sociodemographic characteristics of adolescents. The present study was evaluated and approved by the Ethics Committee (EC) of the Institute, where the authors are employed.

2.2. Measures

The following self-report measures were administered to the participants:

2.2.1. Brief sensation seeking scale – chinese

(BSSS-C; Chen et al., 2013): This is a culturally adapted version of the Brief sensation seeking scale (BSSS-8; Hoyle et al., 2002), and was intended for use with adolescents and adults of china. The BSSS - C has eight items that assess the four known dimensions of sensation seeking: thrill and adventure seeking (TAS), experience seeking (ES), boredom susceptibility (BS), and disinhibition (Dis). The BSSS - C is scored for each of the four factors separately and the total sensation seeking score (SST). The BSSS-C uses a five-point typical Likert response format: strongly disagree = 1, disagree = 2, neither agree nor disagree = 3,

Table 1
Descriptive Statistics (Means and Standard Deviations) of the variables of interest.

Variable	Means and Percentages	Std. Deviations	
Age groups (%)	Age	17.06	1.71
	Mid. adolescents (14 to 17 years)	56.1	–
	Late adolescents (18 to 20 years)	43.9	–
Gender (%)	Male	51	–
	Female	49	–
Residence (%)	Home dwellers	86.5	–
	Hostel dwellers	6.7	–
	Paid guests	6.8	–
BSSS-C	TAS	7.97	1.87
	ES	7.55	1.90
	BS	6.81	1.99
	Dis	6.35	1.89
	SST	28.74	5.43
BIS/BAS	BIS	20.76	3.26
	BAS	40.58	4.90
	Fun Seeking	11.90	2.10
	Drive	11.30	2.32
	Reward Responsiveness	17.31	2.10
Adolescent Risky Behaviours	Risky Sports	3.61	3.41
	Reckless Road Behaviours	6.20	5.35

BSSS-C = Brief Sensation Seeking Scale – Chinese; BAS = Behavioural Activation System; BIS = Behavioural Inhibition System; TAS = Thrill and adventure seeking; ES = Experience seeking; BS = Boredom susceptibility; Dis = Disinhibition; SST = Total sensation seeking score.

agree = 4, and strongly agree = 5. The BSSS-C has demonstrated good internal consistency reliability (Cronbach's $\alpha = .80-.90$) and adequate validity in a community sample of adolescents and adults (Chen et al., 2013).

2.2.2. Behavioural inhibition system and behavioural activation system scales (BIS/BAS; Carver and White, 1994)

BIS/BAS is a 24-item self-report questionnaire that assesses two motivational systems of an individual's personality: Behavioural approach system (BAS) and Behavioural inhibition system (BIS). BAS is sensitive to rewarding stimuli and produces approach behaviours, whereas, BIS is sensitive to punishing stimuli and produces avoidance behaviours. BAS is measured by 13 items and is further fractioned into three factors: Fun seeking (four items), Reward responsiveness (five items), and Drive (four items). BIS is assessed by 7 items. The Cronbach's α was 0.66 and 0.74 for the BIS and BAS respectively in the present study. These values of the internal consistency reliability closely matched to those reported by authors of the scale in their original study (Carver and White, 1994).

2.2.3. Adolescent risky behaviours

The participants were asked to rate their frequency of involvement in two types of risky behaviours: Risky sports (four items) and reckless road behaviours (seven items). The items for the adolescent risky behaviours were taken from a modified version of the adolescent risk behaviour questionnaire (ARBQ; Gullone et al., 2000) that the authors had adapted for the assessment of risk taking in Indian adolescents. Risky sports and reckless road behaviours included items about extreme water sports, parachuting, over speeding, jumping red signals, and so

on. The participants responded to the items on a five-point Likert response format: 0 = never, 1 = hardly, 2 = sometimes, 3 = often and 4 = very often. The Cronbach's alpha (α) for the risky sports and the reckless road behaviours were 0.77 and 0.83, respectively.

2.3. Procedure

The data collection for the present study was carried out in several schools and colleges of the Bengaluru metropolis. The first contact involved seeking written informed assent of the participants below 18 years of age, as well as written informed consent from their parents. The participants who were above 18 years of age were required to provide written informed consent only. The participants who consented to participate were administered a survey, containing the BSSS-C, the BIS/BAS and the Adolescents Risky Behaviours scales, in group settings. The doubts and queries of the participants regarding the survey questionnaire or other aspects of the study were adequately explained.

2.4. Data analysis

Data were analyzed using SPSS and AMOS version 20 (Arbuckle, 2011). The Expectation Maximization (EM) algorithm was used to replace the missing values in the data. Normality was checked using the Q–Q plots, histograms, and the absolute values of skewness and kurtosis. Descriptive statistics (means and standard deviations) and percentages were used to summarise the participant's responses on continuous and categorical variables, respectively. Principal axis factoring (PAF) and confirmatory factor analysis (CFA) were used to examine the replicability and validity of the BSSS-C factor structure in Indian adolescents. Using SPSS random case selection command, we split our data ($n = 2079$) approximately equally between the PAF ($n = 1061$) and the CFA ($n = 1018$). Multi-group confirmatory factor analysis (MG-CFA) was used to test the measurement invariance of the BSSS-C between male and female adolescents. The internal consistency reliability was evaluated using Cronbach's alpha (α). Pearson's correlation analysis was used to examine the construct validity, concurrent validity, as well as the inter-factor correlation of the BSSS-C in Indian adolescents. Two-way MANOVA was used to examine the age and gender interaction effects on the BSSS-C factor scores and total sensation seeking score (SST). Hence, the participants were categorized as mid adolescents (14–17 years) or late adolescents (18–20 years). Level of significance was fixed at 5% for all the analysis.

3. Results

3.1. Descriptive statistics and the preliminary analysis

Table 1 summarises the participant's sociodemographic details and their responses on the BSSS-C, the BIS/BAS, and the adolescent risky behaviour scales using means, standard deviations, and percentages. The data on the BSSS-C was approximately normally distributed, and the skewness and kurtosis values were well within the acceptable range of ± 1 (Tabachnick and Fidell, 2007; Fox, 2008).

3.2. Factor structure of the BSSS-C: exploratory and confirmatory factor analysis

The results of the PAF with promax rotation and the results of the CFA are summarized in Table 2. Careful visual inspection of the scree plot revealed that the four factor structure represents the best interpretable factor solution, which was in line with the findings of the previous studies (Hoyle et al., 2002; Chen et al., 2013; Primi et al., 2011). All of the eight BSSS-C items cleanly loaded onto the four factors, namely: Thrill and adventure seeking (TAS), experience seeking (ES), boredom susceptibility (BS), and disinhibition (Dis). The four factors explained 77.52% of the variance in the observed variables. The

results of the CFA indicated that the four factor model of the BSSS-C, as represented by path diagram in the Fig. 1, exhibited good to excellent model fit with the data ($\chi^2 = 57.48$, $df = 14$, $p < .001$; $\chi^2/df = 4.11$; CFI = 0.98; TLI = 0.96; GFI = 0.99; SRMR = .035, and RMSEA = 0.055). All the confirmatory factor loadings, as summarized in Table 2, were statistically significant. Finally, as shown in Table 3, the four factors of the BSSS - C exhibited significant correlations of moderate to strong magnitude among themselves and with the total sensation seeking score.

3.3. Construct and concurrent validity of the BSSS-C in Indian adolescents

Sensation seeking total (SST) score exhibited moderate to strong correlation with behavioural activation scale ($r = 0.46$, $p < .001$), drive ($r = 0.33$, $p < .001$), and fun seeking ($r = 0.49$, $p < .001$). There was a modest correlation between SST and reward responsiveness ($r = 0.23$, $p < .001$), and a very weak correlation with the Behavioural Inhibition scale ($r = -0.04$, $p < .001$). SST showed significant but modest correlations with risky sports ($r = 0.21$, $p < .001$) and the reckless road behaviours ($r = 0.20$, $p < .001$).

3.4. Measurement Invariance of the BSSS-C across gender in Indian adolescents

The results of the measurement invariance testing of the BSSS-C between male and female adolescents are summarized in Table 4 following the recommendations of Putnick and Bornstein (2016). As depicted in Table 4, we tested the following four essential levels of measurement invariance: Configural invariance, metric invariance, scalar invariance, and residual invariance (Widaman and Reise, 1997). In MG-CFA each of these four levels of measurement invariance is represented by a pair of hierarchically nested measurement models which are compared and examined for model fit decrement. For instance, Invariance at the configural level is tested by comparing the baseline model (M0) with the configural model (M1), that is, M0 – M1, (see Table 4) and so on. Ideally, a non-significant chi-square difference ($\Delta \chi^2$) between any pair of hierarchically nested measurement models (for example, M0 – M1 for configural invariance, M2 – M1 for metric invariance, see Table 4) would indicate the measurement invariance at the configural and the metric level. The same process is repeated for the remaining two levels as well. However, chi-square test being extremely sensitive exaggerates trivial differences in large samples and results in type 1 error (Chen et al., 2005). Therefore, we included changes in alternate fit indices (CFI, RMSEA) cut-offs criteria for establishing measurement invariance of the BSSS-C between male and female adolescents at the four stated levels. Specifically, if ΔCFI is < 0.010 and $\Delta RMSEA$ is $< .015$ between any pair of hierarchically nested models (for example, M0 – M1), the measurement invariance for that level, configural in this case, is accepted (Chen, 2007; Cheung and Rensvold, 2002).

As is evident from the Table 4, the configural model (M1, factor configuration constrained) and the metric invariance model (M2, factor loadings constrained) yielded a non-significant $\Delta \chi^2$ ($p > .05$), with ΔCFI and $\Delta RMSEA$ clearly below their cut-off values. Therefore, the BSSS-C exhibits full configural and metric invariance between male and female adolescents. The scalar invariance model (M3, item intercepts constrained) initially yielded a significant $\Delta \chi^2$ ($p < .01$). However, upon locating the non-invariant item number 8, and after freeing its parameter (item intercept) constraint, the scalar invariance model (M3) also yielded a non-significant $\Delta \chi^2$ ($p > .05$). Additionally, the ΔCFI and the $\Delta RMSEA$ for the respecified scalar invariance model were below their cut-off values, thereby supporting the partial scalar invariance of the BSSS-C between male and female adolescents. Finally, the residual invariance model (M4, item residuals constrained) failed to yield a non-significant $\Delta \chi^2$ ($p < .001$) or below the cut-off level value for ΔCFI . Hence the residual invariance of the BSSS-C between male and

Table 2
Exploratory and confirmatory factor loadings that emerged from the principal axis factoring (PAF) and the confirmatory factor analysis (CFA) of the BSSS-C in Indian Adolescents.

	Item No.	BSSS-C Items	Exploratory Factor loadings	Confirmatory Factor loadings
Factor 1		TAS		
	BSSSC_5	I would love to socialize with adventurous people	.95	.78
Factor 2		ES		
	BSSSC_6	Taking adventures always makes me happy	.63	.83
Factor 3		BS		
	BSSSC_2	I always like to do things that no one else has done before	.80	.76
Factor 4		Dis		
	BSSSC_1	I am interested in almost everything that is new	.64	.67
Factor 3		BS		
	BSSSC_3	I will feel very uncomfortable if I stay in the same place for too long	.74	.71
Factor 4		Dis		
	BSSSC_4	I get restless if I do the same thing for a long time	.63	.77
Factor 4		Dis		
	BSSSC_7	I would do anything as long as it is exciting and stimulating	.69	.93
	BSSSC_8	To pursue new stimulus and excitement, I can go against rules and regulations	.58	.43

BSSSC = Brief sensation seeking scale – Chinese; TAS = Thrill and adventure seeking; ES = Experience seeking; BS = Boredom susceptibility; Dis = Disinhibition.

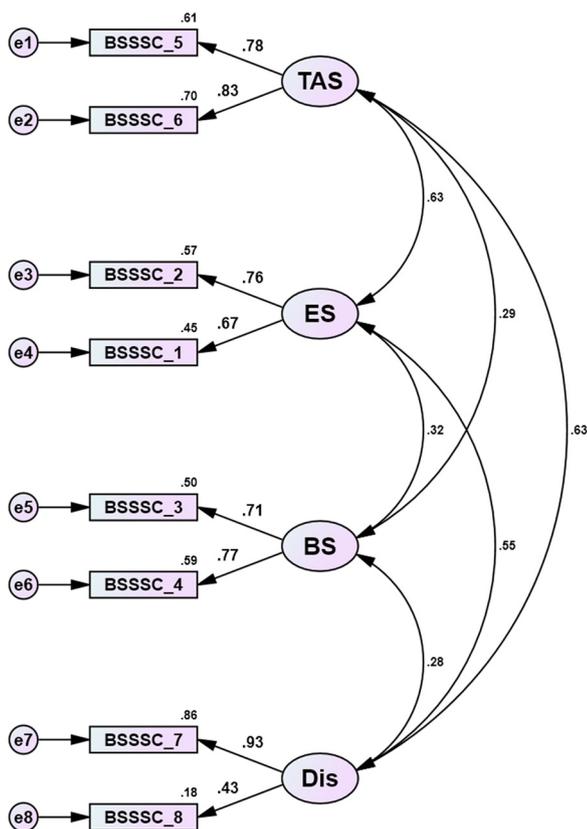


Fig. 1. The AMOS path diagram for the four dimensional factor structure of the BSSS-C in Indian adolescents. BSSS - C = Brief sensation seeking scale – Chinese; TAS = Thrill and adventure seeking; ES = Experience seeking; BS = Boredom susceptibility; Dis = Disinhibition.

Table 3
Correlations among the BSSS-C subscales and their Cronbach’s alpha (α) in Indian Adolescents.

Factors	TAS	ES	BS	Dis	SST	Cronbach’s alpha (α)
TAS	1					.79
ES	.51**	1				.68
BS	.28**	.26**	1			.68
Dis	.44**	.37**	.32**	1		.56
SST	.76**	.74**	.65**	.74**	1	.77

BSSSC = Brief sensation seeking scale – Chinese; TAS = Thrill and adventure seeking; ES = Experience seeking; BS = Boredom susceptibility; Dis = Disinhibition; SST = Total sensation seeking score.

** Correlation is significant at the 0.01 level (2-tailed).

female adolescents was not supported.

3.5. Mean differences on the BSSS-C between male and female adolescents

The two-way MANOVA (between subject factors: age and gender; within subject factors¹: TAS, ES, BS, Dis and SST) indicated a significant main effect for gender ($F_{(4, 1991)} = 8.43, p < .001, \eta_p^2 = .017$), and age ($F_{(4, 1991)} = 5.18, p < .001, \eta_p^2 = .01$), but no significant interaction effect ($F_{(4, 1991)} = .423, p = .79, \eta_p^2 = .001$). The main effect of gender was significant across the SST ($F = 4.78, df = 1, p = .03, \eta_p^2 = .002$), the BS ($F = 5.96, df = 1, p = .02, \eta_p^2 = .003$) and the Dis ($F = 20.22, df = 1, p < .001, \eta_p^2 = .01$) factors of the BSSS-C. Specifically, the male adolescents had slightly higher scores than female adolescents on the SST ($M_m = 28.96, M_f = 28.42$), BS ($M_m = 6.91, M_f = 6.69$) and Dis ($M_m = 6.57, M_f = 6.18$). The main effect of age was observed across the ES ($F = 5.54, df = 1, p = .02, \eta_p^2 = .003$) and Dis ($F = 5.16, df = 1, p = .02, \eta_p^2 = .003$) factors of the BSSS-C. However, a trend effect was observed on the TAS ($F = 3.18, df = 1, p = .08, \eta_p^2 = .002$). Specifically, the mid adolescents scored higher than the late adolescents on ES ($M_{mid} = 7.64, M_{late} = 7.44$), whereas the reverse was true for Dis ($M_{mid} = 6.28, M_{late} = 6.47$).

4. Discussion

BSSS-C has been designed to be a less culture specific tool, and suitable for individuals from developing nations whose modes and opportunities of sensation seeking vary in many respects from individuals of developed nations. The present study sought to validate the factor structure, examine the psychometric properties, and test the measurement invariance of the BSSS-C in Indian adolescents.

The PAF findings of the present study were supportive of the four dimensional theoretical model of sensation seeking construct as described by Zuckerman and colleagues (1978). The four factors, namely TAS, ES, BS, and Dis retained two items each with significant factor loadings that ranged from 0.58 to 0.95. The PAF results were, therefore, consistent with the original studies on the development and validation of the BSSS-C as well as the BSSS – 8, both of which have reported four distinct factor analytic dimensions of sensation seeking (Hoyle et al., 2002; Chen et al., 2013). The confirmatory factor analysis (CFA) of the four factor solution of the BSSS-C in Indian adolescents yielded good to excellent fit with the data. All the confirmatory factor loadings were statistically significant and ranged from 0.43 to 0.93. The CFA model fit indices in our study were similar to those reported for the BSSS-C by

¹ TAS = thrill and adventure seeking, ES = experience seeking, BS = boredom susceptibility, Dis = disinhibition, and SST = sensation seeking total, ²Mm = Mean of male adolescents; ³Mf = Mean of female adolescents M_{mid} = Mean of middle aged adolescents; M_{late} = Mean of late aged adolescents.

Table 4
Measurement Invariance Fit Statistics for the BSSS - C for female and male Indian adolescents.

Model	χ^2 (df)	CFI	RMSEA	Model comp.	$\Delta \chi^2$ (Δ df)	P value	Δ CFI	Δ RMSEA	Decision
M0: Baseline Model	57.48(14)	.98	.055	–	–	–	–	–	–
M1:Configural Invariance	71.96 (28)	.979	.04	M0	14.48(14)	.415	.001	.015	Accept
M2: Metric Invariance	75.83 (36)	.981	.033	M1	3.87 (8)	.869	.002	.007	Accept
M3: Scalar Invariance	86.302 (42)	.979	.032	M2	10.47 (6)	.106	.002	.001	Accept
M4: Residual Invariance	116.08 (49)	.968	.037	M3	29.78 (7)	.000	.011	.005	Reject

χ^2 = Chi-Square; df = degrees of freedom; CFI = comparative fit index; RMSEA = root mean square error approximation; Model comp. = Model comparison.

Chen et al. (2013) and slightly better than those reported for the BSSS-8 by Hoyle et al. (2002). The BSSS-C total score demonstrated acceptable internal consistency reliability (Cronbach's alpha = 0.77) that closely matched the one reported by Hoyle et al. (2002) for the BSSS - 8 in a large sample of adolescents.

The convergent and discriminant validity of the BSSS-C was tested against the BIS/BAS scales that assess two independent motivational systems of an individual's personality. The BSSS-C demonstrated adequate convergent validity as evident from its moderate to strong associations with the BAS as well as its components such as fun seeking and drive. Several previous studies have also reported moderately strong associations between sensation seeking and the Gray's BAS as assessed by sensitivity to reward scale (Torrubia et al., 2001; Conner et al., 2018). The sensation seeking total (SST) score showed a very weak correlation with the BIS and, therefore, demonstrated the discriminant validity of the BSSS-C in Indian adolescents. Previous studies have also reported a weak association between sensation seeking and Gray's BIS as measured by the sensitivity to punishment scale (Torrubia et al., 2001; Conner et al., 2018). Further, the BSSS-C also demonstrated adequate concurrent validity in Indian adolescents as the correlations with the risky sports and reckless road behaviours were significant. These results were also consistent with the findings from previous studies (Jonah, 1997a, b; Dahlen et al., 2005; Murray, 2003; Freixanet, 1991).

The results of the invariance testing supported the configural and metric invariance of the BSSS-C across the gender in Indian adolescents. Therefore, it can be concluded that the same set of items define the four factors of the BSSS-C between male and female adolescents. It also indicates that both the male and female adolescents conceptualize the construct of sensation seeking, as operationalized by the BSSS-C, in a similar manner. The establishment of full metric invariance also indicates that the factor loadings of the BSSS-C items were equivalent between the male and female adolescents. Therefore, it can be concluded that the gender differences in the BSSS-C item scores did arise from the real differences in the underlying construct of sensation seeking between male and female adolescents. The establishment of the partial scalar invariance suggests that one should be careful in comparing latent mean scores on the BSSS-C across gender as the item 8 exhibited a non-invariant item intercept. However, the latent mean scores on the TAS, ES, and BS factors of the BSSS-C are amenable for between groups gender comparison because of their invariant item intercepts.

The results of the two-way MANOVA suggested that the total sensation seeking score (SST) as well as the BSSS-C factor scores were not affected by the differential gender and age combinations, there by supporting the results of previous studies that used the BSSS - 8 (Stephenson et al., 2007; Primi et al., 2011). However, the gender alone affected the SST score as well as the mean scores on BS and Dis factors of the BSSS-C, with males outscoring females. Although, the gender differences on the SST, BS and Dis were statistically significant, yet the effect sizes for these differences were small. Except for the study by Chen et al. (2013), the effect size of gender difference on total sensation seeking score when measured by short form such as the BSSS - 8, has generally been smaller. Overall, our findings on the gender differences in sensation seeking, to a greater extent, support the findings of

previous studies that have documented the prevalent trend of males scoring higher than females on various dimensions of sensation seeking (Cross et al., 2013; Shulman et al., 2015; Butković and Bratko, 2003; Stephenson et al., 2007; Primi et al., 2011; Chen et al., 2013). Although the Dis factor of the BSSS-C appeared to be sensitive to the gender effects, the finding should be interpreted with caution as this factor did not exhibit full scalar invariance between the male and female adolescents. Hence, the difference in the Dis score between the male and female adolescents on the BSSS-C may not be completely reflective of their true differences in the underlying disinhibition levels. The age alone affected the mean scores on the Dis and ES factors of the BSSS-C, with mid adolescents having higher mean scores on ES and lower mean scores on Dis as compared to late adolescents. Again, these differences were statistically significant and had small effect sizes.

In summary, our findings showed that the BSSS-C adequately operationalizes the four dimensional theoretical model of sensation seeking and exhibits good psychometric properties in Indian adolescents. Therefore, the BSSS-C can be used with Indian adolescents to reliably and quickly assess sensation seeking. Additionally, the gender differences in the BSSS-C dimensions can be attributed to the true differences in sensation seeking construct between male and female adolescents. Despite these strengths, the present study is not free of limitations. The study results cannot be generalized to younger adolescents or adolescents with clinical conditions which did not form the part of the study sample. Therefore, the future studies should include samples from these populations and examine the factor structure, psychometric properties, and measurement invariance of the BSSS-C among them. Future studies should also consider the evaluation of other psychometric aspects such as test-retest reliability and criterion validity of the BSSS-C. Despite our best efforts, we still believe that construct validity of the BSSS-C should be examined thoroughly. In the present study, the gender differences, an index of construct validity, were smaller in magnitude as compared to those reported by Chen et al. (2013). Therefore, we feel the need for further replication of the present study and especially with those adolescents, who have substance use disorders, engage in adventurous sports activities or adolescents in conflict with the law.

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Author contributions

The study was conceived by the first, second, and the fourth author. The first author did data collection, data analysis, and manuscript preparation. All the co-authors evaluated the manuscript, suggested modifications in its content, and agreed to the final draft of the manuscript.

Declaration of Competing Interest

We do not have any conflicting interests to declare.

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