Heliyon 8 (2022) e09666

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon

Research article

Bangla version of the Brunel Mood Scale (BRUMS): validity, measurement invariance and normative data in non-clinical sample

M. Mahmudul Hasan [a,b,*], Mozibul H.A. Khan [a]

[a] Department of Psychology, University of Rajshahi, Rajshahi, 6205, Bangladesh
[b] Institute of Bangladesh Studies, University of Rajshahi, Rajshahi, 6205, Bangladesh

ARTICLE INFO

Keywords:
Bangla BRUMS
Mood
Emotion
Mental health
Measurement invariance

ABSTRACT

Mood assessment is an effective way to monitor mental health states and detect potential psychiatric symptoms. The Brunel Mood Scale (BRUMS) is one of the most widely used self-report measures for assessing mood responses. The current study examined the psychometric properties of the Bangla version of BRUMS and validated it with the Positive Mental Health scale (PMH-scale). The participants were 1015 Bangladeshi university students (62% men) aged from 18 to 27 ($M = 21.95$, $SD = 1.95$). The confirmatory factor analysis (CFA) approach was used to test the factor structure of the BRUMS and measurement invariance for sex. The CFA revealed that the originally proposed 6-factor model of BRUMS had an acceptable fit which confirms factorial validity. Moreover, each subscale (anger, confusion, depression, fatigue, tension, and vigor) of the BRUMS showed high internal consistency (α ranged from .77 to .87) and retest reliability (ICC ranged from .71 to .91). Concurrent validity of the BRUMS was supported through the hypothesized relationships with mental health (PMH-scale). Full measurement invariance by sex was confirmed for the 6-factor model indicating that the BRUMS is equally applicable to men and women. Finally, normative data were established which allows group comparison of mood scores. This study indicates that the Bangla version of BRUMS can be reliably used to assess mood response which facilitates mood-related research and intervention to improve mental health and reduce psychiatric disorders in Bangladesh.

1. Introduction

Promoting mental health and preventing psychiatric conditions have become a primary concern in the current days as the prevalence of mental disorders is increasing rapidly over the world (Terry and Parsons-Smith, 2021). The global prevalence of psychiatric disorders among the general population was 10.7% (792 million) in 2017 (Ritchie and Roser, 2018). In addition, the COVID-19 pandemic has led to a dramatic increase in mental health problems worldwide (Nochaiwong et al., 2021). However, psychiatric disorders have a strong relationship with the mood states of individuals, and mood assessment can be an effective way to understand the condition of mental health (Morgan, 1985).

Mood is generally considered as a combination of several feelings or emotional states that fluctuate from time to time in intensity and duration (Han et al., 2020; Lane and Terry, 2000). Unlike emotion, mood is an enduring but less intense feeling that does not require any specific event or stimuli for initiation. While emotion includes general instantaneous responses such as anger, fear, sadness, or happiness, mood contains the feelings of valence (e.g., feeling good or bad) and alertness (e.g., feeling sleepy or active) (Barrett and Russell, 1998; Lane et al., 2017). Furthermore, the effects of emotion are short-lived, causing a change in immediate action and physiology, whereas mood has a broader impact on behavior and cognitive functioning, particularly on thinking and feelings (Quartiroli et al., 2017; Rottenberg, 2005).

The association between mood states and mental health has been studied widely where higher levels of negative moods are suggested as indicators of potential psychiatric disorders (Henriksen et al., 2019; Terry and Parsons-Smith, 2021). However, such research was primarily conducted by using the Profile of Mood States (POMS; McNair et al., 1971), a 65-item self-reported questionnaire that assesses six mood dimensions, namely anger, confusion, depression, fatigue, tension, and vigor.

The POMS was primarily developed for mood assessment among psychiatric outpatients and subsequently among the general people, though later it was used mostly in sports contexts (McNair et al., 1992). To create a shortened version of the POMS, several studies have been

* Corresponding author.
E-mail address: mahmudul.psy@gmail.com (M.H. Hasan).

https://doi.org/10.1016/j.heliyon.2022.e09666
Received 1 November 2021; Received in revised form 21 March 2022; Accepted 31 May 2022

conducted (e.g., Grove and Prapavessis, 1992; Shacham, 1983). However, a 24-item abbreviated POMS called the Brunel Mood Scale (BRUMS) was developed and validated for both adolescents and adults (Terry et al., 1999, 2003). The BRUMS is being widely used as an assessment tool for evaluating mental health in the general people (Brandt et al., 2016), and clinical patients (Galambos et al., 2005); identifying the suicidal tendency among youth (Gould et al., 2005); assessing the risk of post-traumatic stress disorder among military combats (van Wijk et al., 2013); and assessing mood responses to sports performance (Terry, 1995).

The wide range of applications has led BRUMS to be translated and validated in several languages and cultural contexts including Chinese (Zhang et al., 2014), Czech (Květon et al., 2020), French (Rouveix et al., 2006), Italian (Quartiroli et., 2017), Japanese (Yatabe et al., 2006), Malay (Hashim et al., 2010; Lan et al., 2012), Persian (Terry et al., 2012), Singaporean (Han et al., 2020), and Spanish (Cañadas et al., 2017).

To account for the linguistic and cultural differences, psychometric tools are required to translate and validate in a new cultural context (Moustaka et al., 2010). Since a validated tool for assessing mood is not available in Bangladeshi culture, the main objective of the current study is to translate the BRUMS in Bangla, and extend its validation among Bangladeshi university students by testing its psychometric properties. The more specific aims of this study are (a) to test the original 24-item 6-factor measurement model of the BRUMS and compare with other competing models for determining factorial validity; (b) to test the concurrent validity of the BRUMS by using the Positive Mental Health scale (PMH-scale; Lukat et al., 2016); and (c) to demonstrate whether the 6-factor model of BRUMS remains invariant in relation to sex. Furthermore, the BRUMS uses normative data for interpreting individual raw scores. Therefore, the final aim of this study was to establish the norm of BRUMS for overall Bangladeshi adult students and separately for men and women.

Psychometric analysis of the BRUMS would be very useful to use it appropriately in Bangladesh, a densely populated country where the prevalence of the mental disorder is 18.7% and more than 10,000 people die by suicide every year (Sakib, 2021). Therefore, a validated Bangla version of the BRUMS would ensure the opportunity to detect potential psychiatric symptoms and monitor mental health status by assessing mood states.

2. Materials and methods

2.1. Participants

Participants were 1015 university students (630 men, and 385 women) from Rajshahi University, Bangladesh. The age of the participants ranged between 18 and 27 years ($M = 21.95$, $SD = 1.95$). Among the participants 508 were from rural, 186 were from sub-urban, and 321 were from urban areas.

2.2. Instruments

2.2.1. The Brunel mood scale (BRUMS)

The BRUMS (Terry and Lane, 2010) consists of 24 mood descriptor adjectives such as annoyed, confused, sleepy, and energetic. All 24 items are divided into six subscales: anger (items 7, 11, 19, 20), confusion (items 3, 9, 17, 24), depression (items 5, 6, 12, 16), fatigue (items 4, 8, 10, 21), tension (items 1, 13, 14, 18), and vigor (items 2, 15, 20, 23). A 5-point Likert scale with the range of 0 (*not at all*) to 4 (*extremely*) is used for responding. The subscale score ranges between 0 and 16 where a higher score indicates a higher level of the respective feeling. Based on the purpose of a study different response timeframes can be used. In the current study, the timeframe of "How do you feel generally?" was used.

2.2.2. The positive mental health scale (PMH-scale)

Mental health was assessed by using the PMH-scale (Lukat et al., 2016). The PMH-scale is a self-reported measure containing nine items (e.g., "All in all, I am satisfied with my life"). Participants respond to a 4-point Likert scale ranging from 1 (*not true*) to 4 (*true*). The unidimensional nature of PMH-scale allows calculating a composite score ranging from 9 to 36 where a higher score indicates better mental health. The Bangla PMH-scale (Hasan, 2020) had good reliability, and the Cronbach's alpha was 0.84 in the current sample.

2.3. Procedure

The Bangla translation of BRUMS was conducted based on the guidelines of the International Test Commission (2017). A back-translation method was applied to ensure higher accuracy of the translated items (Hernández et al., 2020). Firstly, the English items of the BURMS were translated into Bangla by two experts who were fluent in both English and Bangla. Then a Bangla version of BRUMS was prepared from those translations. The back-translation was conducted by a third translator who had no previous familiarity with the English items of the BRUMS. There was no major discrepancy between the original items and back-translated items of BRUMS. Finally, the language equivalency of the Bangla BRUMS was determined through a group discussion (International Test Commission, 2017, pp. 13–14) where nine bilingual students participated from the University of Rajshahi, Bangladesh. The participants agreed on the comprehensibility of the Bangla items of BRUMS, and thus the Bangla version of the BRUMS was finalized (see supplementary file). Through an online survey, the participants completed the Bangla BRUMS in addition to the PMH-scale. After an average of 10 days intervals, a retest measure was taken from 40 participants who agreed to participate in the retest.

2.4. Ethical approval

The Academic/Ethics Committee of the Department of Psychology, Rajshahi University, Bangladesh approved the ethical issues for conducting this study. All the ethical standards suggested by the committee were maintained when conducting this study. In addition, this study complied with the Code of Ethics of the World Medical Association Declaration of Helsinki. The participants were informed about the nature and objectives of the study. Then, they were assured that they had free choice to accept or refuse participation in this study, and thus participants' informed consent was obtained. All participation was voluntary and without any reward.

2.5. Statistical analysis

Descriptive statistics (*M, SD*) were performed for individual item and subscale of BRUMS. The internal consistency and test-retest reliability were determined through Cronbach's alpha and Intra-class Correlation Coefficient (ICC), respectively. These analyses were performed using IBM SPSS Statistics 25.

To test the measurement model of the Bangla version of BRUMS confirmatory factor analysis (CFA) using the maximum likelihood method was performed in AMOS 21.0. The latent factors (anger, confusion, depression, fatigue, tension, and vigor) were allowed to intercorrelate based on the theoretical predictions and previous empirical support (Lan et al., 2012; Terry et al., 2012; Zhang et al., 2014). Adequacy of the model was evaluated through a range of fit indices including non-significant Chi-square ($\chi 2$), the comparative fit index (CFI $\geq$.90), the Tucker Lewis index (TLI $\geq$.90), and the root-mean-square error of approximation (RMSEA $\leq$.08) (Hu and Bentler, 1999).

Multi-group CFA was conducted to test the factorial invariance of the measurement model of the Bangla version of BRUMS across groups (men and women). The factorial invariance was examined by (i) releasing equality constraints on the model parameters including item intercepts, factor loading, and residual variances (configural invariance); (ii) imposing equality constraints on factor loadings (metric invariance); (iii) imposing equality constraints on item intercepts (scalar invariance); and

finally, (iv) imposing equality constraints on factor variances and covariances across groups along with factor loadings and item intercepts (structural invariance). The configural, metric, scalar and structural invariances determine the equivalence of factor structure, factor loadings, item intercepts, and error variance, respectively, across groups (Byrne, 2010). The multi-group invariance was determined through the difference in CFI (ΔCFI <0.01) and RMSEA (ΔRMSEA <0.015) (Cheung and Rensvold, 2002).

3. Results

Initially, the normality of the data was inspected through skewness and kurtosis. The values of skewness and kurtosis were not too extreme (see Table 1) on this large sample which indicated reasonable normality of the score distribution (Hair et al., 2006). Then, CFA was applied to test the following models of BRUMS found in previous studies: (a) a 1-factor model; (b) a 2-factor model containing positive mood and negative mood (Hashim et al., 2010); (c) a 2-factor higher order model containing an additional higher order latent factor of negative mood (Hashim et al., 2010; Zhang et al., 2014); and (d) the original six-factor model (Terry et al., 2003). Table 1 showed the standardized factor loading of BRUMS items. All the factor loadings were significantly high which supported the validity of six-factor model of BRUMS.

The model fit information of the BRUMS models tested is presented in Table 2. The 1-factor (model-a) and 2-factor model (model-b) did not show a good fit. However, the fit indices for the 2-factor higher order model and 6-factor model were in an acceptable range. But the six-factor model showed improvement when two pairs of items (depressed-downhearted and panicky-nervous) were allowed to covary. Generally, "depressed" and "downhearted" belong to the depression subscale while "panicky" and "nervous" belong to the tension subscale. Therefore, allowing these items to covary remained consistent with theoretical perspective and also with previous findings (Terry et al., 2003; Zhang et al., 2014).

Table 1. Descriptive statistics and factor loading for the items of the BRUMS.

Items	*M*	*SD*	Skewness	Kurtosis	Standardized Factor Loading
Anger subscale					
Annoyed	1.49	1.18	.63	-.56	.72
Bitter	.86	1.08	1.28	.93	.76
Angry	1.27	1.17	.77	-.24	.86
Bad tempered	1.17	1.21	.92	-.09	.84
Confusion subscale					
Confused	1.27	1.06	.78	-.06	.69
Mixed up	.80	.97	1.24	1.08	.76
Muddled	.94	1.10	1.21	.75	.65
Uncertain	1.24	1.13	.95	.17	.75
Depression subscale					
Depressed	1.34	1.21	.73	-.46	.80
Downhearted	1.23	1.16	.92	-.02	.81
Unhappy	1.02	1.18	1.14	.37	.84
Miserable	.84	1.05	1.32	1.19	.76
Fatigue subscale					
Worn out	1.14	.97	.71	.05	.58
Exhausted	.84	1.01	1.21	.91	.81
Sleepy	1.14	1.01	.78	.11	.50
Tired	1.06	.97	.99	.79	.82
Tension subscale					
Panicky	.97	.93	.97	.76	.49
Anxious	1.20	1.07	.96	.39	.84
Worried	1.34	1.18	.82	-.16	.87
Nervous	.76	.93	1.39	1.81	.65
Vigor subscale					
Lively	1.80	.94	-.22	-.37	.57
Energetic	1.69	.98	-.01	-.53	.75
Active	1.70	.99	.00	-.37	.81
Alert	1.71	.99	.12	-.37	.78

Table 2. Fit indices for the alternative measurement models of Bangla BRUMS.

Model	χ^2			TLI	CFI	RMSEA
	Value	*df*	χ^2/df			
(a) 1-factor Model	3193.0*	252	12.67	0.782	0.801	0.107
(b) 2-factor Model	2298.99*	251	9.16	0.847	0.861	0.090
(c) 2-factor higher order Model	1466.28*	246	5.96	0.907	0.917	0.070
(d) 6-factor Model	1242.16*	235	5.29	0.920	0.932	0.065

Note. *$p < .05$; TLI = Tucker-Lewis index; CFI = comparative fit index; RMSEA = root mean square error of approximation.

The Cronbach's alpha values for the BRUMS subscales ranged from .77 to .87 which implied a good internal consistency. Similarly, the BRUMS subscales had high test-retest reliability where ICC values ranged from .71 to .91 (see Table 3). The inter-correlations of the mood dimensions of BRUMS were strong and remained consistent with the theoretical issues. Namely, negative moods (anger, confusion, depression, fatigue, and tension) were positively correlated with each other while negatively correlated with vigor. Furthermore, mental health (PMH) was negatively correlated with the five negative moods of BRUMS and positively correlated with vigor (see Table 4) indicating the concurrent validity.

As the original 6-factor model of the BRUMS had the best fit, it was further used for multi-group CFA. The fit indices found for configural invariance were adequate. Likewise, the values of ΔCFI and ΔRMSEA were in the acceptable range (<.01) which indicated that the 6-factor model of BRUMS was completely invariant (metric, scalar, and structural invariant) by sex (see Table 5).

Finally, this study developed normative data of the Bangla version of BRUMS for the overall sample (see Table 6), and separately for men (see Table 7) and women (see Table 8). The norms are computed following the suggestion of Terry and Lane (2010). These norms will help to understand both within and across group differences in raw scores. For example, a T-score of 50 among women corresponds to a raw score of 5 for tension but a raw score of 6 for anger (see Table 8). Similarly, a T-score of 50 for anger corresponds to a raw score of 4 among men but a raw score of 6 among women (see Tables 7 and 8).

4. Discussion

This study assessed the factorial validity, internal consistency, retest reliability, and measurement invariance of the BRUMS to extend its validation in Bangladeshi culture. In addition, the normative data of the BRUMS were also established for Bangladeshi people. Results of the CFA confirmed that the originally proposed 6-factor model of the BRUMS had

Table 3. Descriptive statistics and reliabilities of the BRUMS subscales.

BRUMS subscales	*M*	*SD*	Alpha	ICC
Anger	4.80	3.92	.87	.71
Confusion	4.24	3.37	.80	.91
Depression	4.44	3.98	.87	.86
Fatigue	4.18	3.04	.77	.87
Tension	4.28	3.31	.82	.91
Vigor	6.90	3.12	.81	.81

Note. ICC = Intra-class correlation coefficients.

Table 4. Correlations between the BRUMS subscales and mental health.

Variables	Anger	Confusion	Depression	Fatigue	Tension	Vigor
Anger	1					
Confusion	.707**	1				
Depression	.752**	.773**	1			
Fatigue	.582**	.629**	.641**	1		
Tension	.690**	.755**	.811**	.612**	1	
Vigor	-.390**	-.459**	-.428**	-.361**	-.399**	1
Mental health	-.546**	-.578**	-.604**	-.467**	-.556**	.485**

Note. $^{**}p < .01$.

Table 5. Measurement invariance of 6-factor BRUMS.

Model	Model Fit						Model Comparison	
	χ^2	*df*	χ^2/df	TLI	CFI	RMSEA	ΔCFI	ΔRMSEA
Configural	1607.8*	470	3.42	.907	.921	.049	-	-
Metric	1664.72*	488	3.41	.908	.918	.049	-.003	.000
Scalar	1728.57*	509	3.39	.908	.915	.049	-.003	.000
Structural	1840.52*	535	3.44	.907	.909	.049	-.006	.000

Note. $^{*}p < .05$, TLI = Tucker-Lewis index; CFI = comparative fit index; RMSEA = root mean square error of approximation.

Table 6. BRUMS normative scores (T-score) for all sample (N = 1015).

Raw Score	Anger	Confusion	Depression	Fatigue	Tension	Vigor
0	38	37	39	36	37	28
1	40	40	41	40	40	31
2	43	43	44	43	43	34
3	45	46	46	46	46	38
4	48	49	49	49	49	41
5	51	52	51	53	52	44
6	53	55	54	56	55	47
7	56	58	56	59	58	50
8	58	61	59	63	61	54
9	61	64	61	66	64	57
10	63	67	64	69	67	60
11	66	70	67	72	70	63
12	68	73	69	76	73	66
13	71	76	72	79	76	70
14	73	79	74	82	79	73
15	76	82	77	86	82	76
16	79	85	79	89	85	79

Table 7. BRUMS normative scores (T-score) for men (N = 630).

Raw Score	Anger	Confusion	Depression	Fatigue	Tension	Vigor
0	38	38	39	36	37	26
1	41	41	42	40	41	30
2	44	44	45	43	44	33
3	47	48	47	47	47	36
4	50	51	50	51	51	39
5	52	54	53	55	54	43
6	55	57	56	58	57	46
7	58	61	58	62	61	49
8	61	64	61	66	64	52
9	63	67	64	69	67	56
10	66	70	67	73	71	59
11	69	74	69	77	74	62
12	72	77	72	81	78	65
13	74	80	75	84	81	69
14	77	83	77	88	84	72
15	80	87	80	92	88	75
16	83	90	83	96	91	79

a good fit to the data as compared to the 1-factor, 2-factor and, 2-factor higher order models.

The Cronbach's alpha and ICC values indicated high internal consistency and retest reliability, respectively, for each subscale of the BRUMS. The alpha values remained within the range as reported in the earlier studies (Quartiroli et al., 2017). Previous studies did not report retest reliability though Quartiroli et al. (2017) mentioned its necessity to determine how well the BRUMS performs over multiple assessments. However, this study confirmed the retest reliability of the Bangla version of BRUMS which indicated the consistency of the BRUMS over time.

The inter-correlations found between the BRUMS subscales are consistent with the earlier findings. The negative moods (anger, confusion, depression, fatigue, and tension) of the BRUMS were strongly correlated with each other which implied that these subscales measure distinct but related construct (Zhang et al., 2014). In contrast, vigor was inversely correlated with the five negative moods as hypothesized (Quartiroli et al., 2017; Terry et al., 2003).

The association of the BRUMS subscales with mental health was in line with earlier studies which supports its concurrent validity. Mental health was negatively associated with anger, confusion, depression, fatigue, and tension while positively correlated with vigor (Brandt et al., 2016; Morgan et al., 1987). This finding was also consistent with the mental health model proposed by Morgan (1980) which states better mental health indicates higher vigor with lower anger, confusion, depression, fatigue, and tension.

The multi-group analysis of the 6-factor measurement model of BRUMS confirmed factor invariance across men and women. The fit indices for configural, metric, scalar, and structural invariances were adequate in the current sample. The confirmation of the configural invariance indicates that the 6-factor model of BRUMS is equally applicable for both men and women. Metric invariance reflects the same metric for the latent factors of BURMS across groups (Lukat et al., 2016). The establishment of the scalar invariance allows comparing latent group means (Esnaola et al., 2017). The structural invariance ensures the

Table 8. BRUMS normative scores (T-score) for women (N = 385).

Raw Score	Anger	Confusion	Depression	Fatigue	Tension	Vigor
0	36	36	38	36	36	30
1	39	39	40	39	39	33
2	41	42	43	42	42	36
3	43	45	45	45	44	39
4	46	47	47	48	47	43
5	48	50	49	51	50	46
6	50	53	52	53	53	49
7	53	55	54	56	55	52
8	55	58	56	59	58	55
9	58	61	59	62	61	59
10	60	63	61	65	63	62
11	62	66	63	68	66	65
12	65	69	66	71	69	68
13	67	72	68	74	72	71
14	70	74	70	76	74	75
15	72	77	73	79	77	78
16	74	80	75	82	80	81

equality of reliability of the BRUMS subscales across groups (Byrne, 2010). In sum, the invariance test concludes that the BRUMS is appropriate for both men and women, and valid for comparing mood scores over the group.

Finally, this study developed the normative data for Bangladeshi people to interpret the raw mood scores. Although the conceptual basis of mood construct is similar, men and women differ in mood responses (Quartiroli et al., 2017). Interpreting men's scores against women might cause an inappropriate conclusion (Terry and Parsons-Smith, 2021). Therefore, the norms are determined separately for men and women which allows both within and across group comparison.

4.1. Limitations and recommendations

There are some limitations to this study. Firstly, being an online survey this study had the limitations of online survey. Secondly, the participants of this study were predominantly university students selected through a non-random sampling method. Therefore, it should be cautioned to generalize the findings to other populations. Thirdly, the measurement invariance was established only for men and women, and thus further studies are required to confirm invariance on other groups such as age and clinical patients groups.

Despite the limitations, the psychometric properties of the Bangla version of BRUMS were satisfactory. This measure has several applications, particularly on assessing mood in sports and medical patients, evaluating the effectiveness of any psychiatric intervention, monitoring mental health status at individual and population-level, and identifying the risk of potential psychiatric disorder and suicidality (Quartiroli et al., 2017; Zhang et al., 2014). However, it should be cautioned that the BRUMS is not a comprehensive measure of mood, and it should not be used as a diagnostic tool (Lane and Terry, 2000). Moreover, it is suggested to use appropriate norms of the BRUMS (Terry and Parsons-Smith, 2021). As this study was limited only to the student sample, further studies are required to generate the norm for other populations (e.g., psychiatric patients, athletes, military) and other age groups.

5. Conclusion

The current study demonstrated that the Bangla version of BRUMS is a psychometrically sound tool for assessing mood. Furthermore, the measurement invariance of BRUMS ensures the suitability of group comparison through the established norms. Given the alarming increase in mental health problems both nationally and globally, the Bangla version of BRUMS would be very useful to detect psychiatric symptoms, and thus enable us to design effective intervention programs for those at risk. Therefore, this study facilitates further research and intervention to reduce psychiatric disorders and sustain better mental health in Bangladesh.

Declarations

Author contribution statement

M. Mahmudul Hasan: Conceived and designed the analysis; Analyzed and interpreted the data; Wrote the paper.

Mozibul H. A. Khan: Conceived and designed the analysis; Contributed analysis tools or data; Wrote the paper.

Funding statement

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Data availability statement

Data will be made available on request.

Declaration of interest's statement

The authors declare no conflict of interest.

Additional information

Supplementary content related to this article has been published online at https://doi.org/10.1016/j.heliyon.2022.e09666.

References

Barrett, L.F., Russell, J.A., 1998. Independence and bipolarity in the structure of current affect. J. Pers. Soc. Psychol. 74, 967–984.

Brandt, R., Herrero, D., Massetti, T., Crocetta, T.B., Guarnieri, R., Monteiro, C.B.D.M., Viana, M.D.S., Bevilacqua, G.G., de Abreu, L.C., Andrade, A., 2016. The Brunel Mood Scale rating in mental health for physically active and apparently healthy populations. Health 8, 125–132.

Byrne, B.M., 2010. Structural Equation Modeling with AMOS: Basic Concepts, Applications, and Programming, second ed. Routledge, New York.

Cañadas, E., Monleón, C., Sanchis, C., Fargueta, M., Blasco, E., 2017. Spanish validation of BRUMS in sporting and non-sporting populations. Eur. J. Hum. Mov. 38, 105–117. Available online: http://www.eurjhm.com/index.php/eurjhm/article/view/413/608. (Accessed 26 September 2021).

Cheung, G.W., Rensvold, R.B., 2002. Evaluating goodness-of-fit indexes for testing measurement invariance. Struct. Equ. Model Multidiscip. J. 9, 233–255.

Esnaola, I., Benito, M., Agirre, I.A., Freeman, J., Sarasa, M., 2017. Measurement invariance of the Satisfaction with Life Scale (SWLS) by country, gender and age. Psicothema 29 (4), 596–601.

Galambos, S.A., Terry, P.C., Moyle, G.M., Locke, S.A., 2005. Psychological predictors of injury among elite athletes. Br. J. Sports Med. 39, 351–354.

Gould, M.S., Marrocco, F.A., Kleinman, M., Thomas, J.G., Mostkoff, K., Cote, J., Davies, M., 2005. Evaluating iatrogenic risk of youth suicide screening programs: a randomized controlled trial. J. Am. Med. Assoc. 293, 1635–1643.

Grove, J.R., Prapavessis, H., 1992. Preliminary evidence for the reliability and validity of an abbreviated Profie of Mood States. Int. J. Sport Psychol. 23, 93–109.

Hair, J.F., Black, W.C., Babib, B.J., Anderson, R.E., Tatham, R.L., 2006. Multivariate Data Analysis, sixth ed. Pearson Education, NJ.

Han, C., Parsons-Smith, R.L., Fogarty, G.J., Terry, P.C., 2020. Psychometric properties of the Brunel mood scale in a Singaporean sporting context. Int. J. Sport Exerc. Psychol. 19.

Hasan, M.M., 2020. Morningness-eveningness of Undergraduate Students on Mood and Psychological Well-Being [Unpublished master's thesis]. University of Rajshahi, Bangladesh.

Hashim, H.A., Zulkifli, E.Z., Yusof, H.A., 2010. Factorial validation of Malaysian adapted Brunel Mood Scale in an adolescent sample. Asian J. Sports Med. 1, 185.

Henriksen, K., Schinke, R., Moesch, K., McCann, S., Parham, W.D., Larsen, C.H., Terry, P., 2019. Consensus statement on improving the mental health of high-performance athletes. Int. J. Sport Exerc. Psychol. 18, 553–560.

Hernández, A., Hidalgo, M.D., Hambleton, R.K., Gomez-Benito, J., 2020. International test commission guidelines for test adaptation: a criterion checklist. Psicothema 32 (3), 390–398.

Hu, L.T., Bentler, P.M., 1999. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. Struct. Equ. Model. 6, 1–55.
International Test Commission, 2017. The ITC Guidelines for Translating and Adapting Tests, second ed. https://www.InTestCom.org. (Accessed 18 January 2021).
Květon, P., Jelínek, M., Burešová, I., Bartošová, K., 2020. Czech adaptation of the Brunel Mood States for adolescent athletes. Studia. Sport 14, 47–57.
Lan, M.F., Lane, A.M., Roy, J., Hanin, N.A., 2012. Validity of the Brunel mood scale for use with Malaysian athletes. J. Sports Sci. Med. 11, 131–135.
Lane, A.M., Terry, P.C., 2000. The nature of mood: development of a conceptual model with a focus on depression. J. Appl. Sport Psychol. 12, 16–33.
Lane, A.M., Terry, P.C., Devonport, T.J., Friesen, A.P., Totterdell, P.A., 2017. A test and extension of Lane and terry's (2000) conceptual model of mood-performance relationships using a large internet sample. Front. Psychol. 8, 470.
Lukat, J., Margraf, J., Lutz, R., van der Veld, W.M., Becker, E.S., 2016. Psychometric properties of the positive mental health scale (PMH-scale). BMC Psychol. 4 8.
McNair, D.M., Lorr, M., Droppelman, L.F., 1971. Manual for the Profile of Mood States, first ed. Educational and Industrial Testing Services, San Diego, CA, USA.
McNair, D.M., Lorr, M., Droppleman, L.F., 1992. Revised Manual for the Profile of Mood States. Educational and Industrial Testing Services, CA, San Diego.
Morgan, W.P., 1980. Test of champions the iceberg profile. Psychol. Today 14, 92.
Morgan, W.P., 1985. Selected psychological factors limiting performance: a mental health model. In: Clarke, D.H., Eckert, H.M. (Eds.), Limits of Human Performance. Human Kinetics, Champaign, IL, USA, pp. 70–80.
Morgan, W.P., Brown, D.R., Raglin, J.S., O'Connor, P.J., Ellickson, K.A., 1987. Psychological monitoring of overtraining and staleness. Br. J. Sports Med. 21, 107–114.
Moustaka, F.C., Vlachopoulos, S.P., Vazou, S., Kaperoni, M., Markland, D.A., 2010. Initial validity evidence for the Behavioral Regulation in Exercise Questionnaire-2 among Greek exercise participants. Eur. J. Psychol. Assess. 26, 269–276.
Nochaiwong, S., Ruengorn, C., Thavorn, K., Hutton, B., Awiphan, R., Phosuya, C., Ruanta, Y., Wongpakaran, N., Wongpakaran, T., 2021. Global prevalence of mental health issues among the general population during the coronavirus disease-2019 pandemic: a systematic review and meta-analysis. Sci. Rep. 11, 10173.
Quartiroli, A., Terry, P.C., Fogarty, G.J., 2017. Development and initial validation of the Italian Mood Scale (ITAMS) for use in sport and exercise contexts. Front. Psychol. 8, 1483.
Ritchie, H., Roser, M., 2018. Mental Health. Available online: https://ourworldindata.org/mental-health. (Accessed 26 September 2021).
Rottenberg, J., 2005. Mood and emotion in major depression. Curr. Dir. Psychol. Sci. 14 (3), 167–170.
Rouveix, M., Duclos, M., Gouarne, C., Beauvieux, M., Filaire, E., 2006. The 24 h Urinary cortisol/cortisone ratio and epinephrine/norepinephrine ratio for monitoring training in young female tennis players. Int. J. Sports Med. 27, 856–863.
Sakib, S.M.N., 2021. Bangladesh: Mental Health Stigma a Barrier to Care. https://www.aa.com.tr/en. (Accessed 26 September 2021).
Shacham, S., 1983. A shortened version of the profile of mood states. J. Pers. Assess. 47, 305–306.
Terry, P., 1995. The efficacy of mood state profiling with elite performers: a review and synthesis. Sport Psychol. 9, 309–324.
Terry, P.C., Lane, A.M., Lane, H.J., Keohane, L., 1999. Development and validation of a mood measure for adolescents. J. Sports Sci. 17, 861–872.
Terry, P.C., Lane, A.M., 2010. User guide for the Brunel Mood Scale (BRUMS). Toowoomba (QLD). Peter Terry Consultants.
Terry, P.C., Lane, A.M., Fogarty, G.J., 2003. Construct validity of the profile of mood states-adolescents for use with adults. Psychol. Sport Exerc. 4, 125–139.
Terry, P.C., Malekshahi, M., Delva, H.A., 2012. Development and initial validation of the farsi mood scale. Int. J. Sport Exerc. Psychol. 10, 112–122.
Terry, P.C., Parsons-Smith, R.L., 2021. Mood Profiling for sustainable mental health. Sustainability 2021 (13), 6116.
van Wijk, C.H., Martin, J.H., Hans-Arendse, C., 2013. Clinical utility of the Brunel Mood Scale in screening for post-traumatic stress risk in a military population. Mil. Med. 178, 372–376.
Yatabe, K., Oyama, T., Fujiya, H., Kato, H., Seki, H., Kohno, T., 2006. Development and validation of the preliminary Japanese version of the profile of mood states for adolescents. St. Marian. Med. J. 32, 539–547.
Zhang, C.Q., Si, G., Ching, P.K., Du, M., Terry, P.C., 2014. Psychometric properties of the Brunel mood scale in Chinese adolescents and adults. J. Sports Sci. 32, 1465–1476.