

Psychometric properties of short version of revised anxiety scale for Bangladeshi population

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Summary

The anxiety scale, developed by Deeba and Begum in 2004 is the most used scale to clinically measure the anxiety in Bangladesh. After ten years, Sarker, Deeba and Begum reviewed the scale in 2018. Since the utility of the scale for everyday clinical work was deemed not very prospective, so the scale was examined again on 147 participants (87 clinical and 60 non-clinical participants) from May 2020 to April 2021. The exploratory factor analysis (EFA) suggests a two-factor solution of the short version of revised anxiety scale for Bangladeshis (R-AS, B), social factor and physiological factor and yielded 17 items significantly corresponding to the factors. Confirmatory factor analysis was conducted followed by that on those 17 items of the measure for supporting social and physiological factors. Split-half reliability of the scale was found 0.93 ($\hat{\alpha}=0.01$) and the Cronbach-alpha reliability was 0.94 for the measure. The test-retest reliability ($r=0.45$) was also found to be significant ($\hat{\alpha}=0.01$). Content validity of the scale was established by strictly following the sequential system model of scale development and by multiple experts' evaluations on scale items. The depression anxiety stress scale (DASS) 21 was selected as an external criterion to assess the criterion related validity and found to be positive correlated with the present scale ($r=0.78$). A percentile rank of this scale was determined for the purpose of the clinical usage of the measure; where we had found that scores within 0-30 could be considered as mild anxiety, 31-43 as moderate anxiety, 44-53 as severe anxiety and 54-68 as profound anxiety. The screening norm was found 19.5.

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Introduction

Anxiety is an emotion characterized by heightened autonomic system activity, specifically activation of the sympathetic nervous system (i.e. increased heart rate, blood pressure, respiration and muscle tone), subjective feelings of tension, and cognitions that involve apprehension and worry.¹ Anxiety disorder and comorbid anxiety problems are most common psychological problems in Bangladesh like any other communities in the world.² Globally about 284 million people were living with a type of anxiety disorder.³ The World Health Organization in 2017 reported that anxiety alone accounts for 6.9 million mental health cases in Bangladesh. In a more recent study by the National Mental Health Survey of Bangladesh (2019) suggested that the total number of mental health problems among the adult population was 16.8%, among them 4.5% were suffering from anxiety related disorders.⁴ Although people in Bangladesh have been experiencing heightened mental health problems over the last few decades, the human resources working in different sectors include approximately 260 psychiatrists and 565 psychologists.⁵ This indicates a sheer scarcity of trained mental

health professionals in Bangladesh as they are burdened with the responsibilities of supporting the people with immediate mental health diagnosis and treatment. It is undeniable that the availability of assessment and measurement of severity of mental health problems by a reliable and valid tool could save both times and already burdened human resources for identifying the potential cases for appropriate mental health services.⁶

In Bangladesh, mental health professionals have very few tools to assess various psychological problems, including anxiety, depression, and stress. For the assessment of anxiety, Beck Anxiety Inventory,⁷ Depression Anxiety Stress Scales (DASS 21),⁸ Hospital Anxiety and Depression Scale (HADS),⁹ Patient Health Questionnaire-4 (PHQ 4),¹⁰ the Social Phobia and Anxiety Inventory¹¹ have been used by the health professionals. Besides, there are some Bengali translated measurement tools as well, i.e., Hospital Anxiety and Depression Scale (HADS),¹² Depression Anxiety Stress Scale (DASS 21)¹³ and so on. Most of tools were developed in the context of western communities. Thus, Deeba and Begum (2004)¹⁴ developed the Anxiety Scale (AS), and it became the most widely used tool to measure the

anxiety in Bangladesh, for both clinical assessment¹⁵⁻¹⁸ as well as research purposes.¹⁹⁻²⁵ The AS has also been used in many unpublished academic research in Bangladesh.^{18,26-29} The tool contained 36 items rated in five-point Likert-scale ranging from 0 (not at all) to 4 (very much), and it was developed following the suggestions of the then mental health experts as well as the symptoms described in DSM-IV-TR.³⁰ The use of the AS in both academic and professional works establishes the content validity and utility of this tool, however, it required an update as the International Test Commission (ITC) guideline (2015)³¹ suggests that a psychometric test should be revised in 10 years and would be based on an updated diagnostic standard. Moreover, there are some specific differences in the description of anxiety disorder in DSM IV TR to DSM 5.³²

Therefore, the scale was revised, and a newer version was developed, the Revised Anxiety Scale for Bangladeshi people (R-AS, B), by Sarker, Deeba and Begum (2018).³³ The R-AS, B items were revised following the criteria of anxiety disorders as described by the DSM 5³² and the suggestions made by the Bangladeshi mental health professionals (psychiatrists, clinical psychologists, and senior psychologists in practice). In the R-AS, B, 40 items were retained. Since the R-AS, B contained 40 items, and may not be manageable by the clinicians and researchers for a quick assessment. Therefore, a more rigorous exploratory factor analysis using stringent criteria was used to find out the scopes to reduce some items and make it readily usable.

Materials and methods

The current cross sectional study used the responses of a total of 147 (87 clinical and 60 non clinical participants) that were collected for the study of Sarker, Deeba and Begum (2018).³³ The study was conducted from May 2020 to April 2021. The 87 clinical (diagnosed anxiety) participants from two government hospitals i.e. National Institute of Mental Health (NIMH) and Bangabandhu Sheikh Mujib Medical University (BSMMU) and three private clinics (Arc Center for Counseling and Psychotherapy, Center for Mental Health Care Bangladesh (CMHCB), and Monobikash) in Dhaka city were used for the exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) of the study. All clinical participants were diagnosed with an anxiety disorder by the psychiatrist. Then the reliability, validity and percentile norms were calculated with the total clinical and nonclinical sample of the study. The non clinical 60 participants were collected from normal non anxious population of Dhaka city, those who have not face mental health problems and did not receive any mental health treatment. For calculating the test retest reliability of the measure, a total of 60 non-clinical participants were interviewed twice within 2 to 3 weeks interval time and participants were collected as convenient sampling.³⁴ A socio-demographic information collection form was used to collect information about age, marital status, educational level, occupation,

socio-economic status based on monthly family income, location of residence etc. The Revised Anxiety Scale, Bangla (R-AS, B) has 40 five-point Likert-scale items. Inter rater reliability of this scale was good (Cronbach's $\alpha=0.85$). Split-half reliability of the scale was 0.94 ($\alpha=0.01$) and the Cronbach's α was excellent ($\alpha=0.93$). The test-retest correlation coefficient was found satisfactory as well ($r=0.50$). The content validity of the scale was ensured by strictly following the sequential system model of the scale development and by the evaluations of scale items by experts. The depression anxiety stress scale (DASS) 21 was designed to measure depression, anxiety, and stress among the adults.¹³ The Cronbach's α for the DASS 21 was found 0.78 in our study and for the subscales were 0.61 for depression, 0.76 for anxiety and 0.69 for stress. This study was funded from Australian high commission, Bangladesh through Psychological Assessment Clinic (PAC), department of clinical Psychology, university of Dhaka. The study procedure was reviewed and approved by the research ethical committee of the Department of Clinical Psychology, University of Dhaka (project no: MS180201 dated 25/03/2018). Ethical permission was also taken from the relevant institutions as well, e.g., NIMH (memo No: NIMH/2018/623) and BSMMU. The description on the procedure of data collection is available elsewhere.³³ Data were analyzed in two phases using the statistical package for the social sciences (SPSS) and analysis of moment structures (AMOS), version 23, respectively. Using SPSS, the socio-demographic information of the participants was reported by descriptive analysis, including frequencies, percentages, and central tendency (mean and standard deviation). The EFA, considering three methods, such as Kaiser's criteria, scree plot and parallel analysis, was conducted by SPSS to determine the number of factors of R-AS, B. Following EFA, Cronbach's α was used to measure the internal consistency of the factor structures of R-AS, B. Finally, the CFA was executed by AMOS. The goodness of fit of the construct was verified by composite fit index (CFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR).³⁵⁻³⁷ Later, the R-AS, B was validated by using the average variance extracted (AVE) and construct reliability (CR).³⁸ Finally, different reliability matrix (Cronbach's α , Split-half reliability and test-retest reliability) and validity were measured. The concurrent validity was measured by Pearson's product-moment correlations between R-AS, B and DASS 21 using the SPSS.

Results

The results showed that, among 87 clinical samples age range was 18 to 65 years (mean age=28.39 years, SD=7.71). Among them there were 44 male (50.6%) and 43 female (49.4%) participants. For 60 non-clinical samples, the age range was 18 to 62 years (Mean age \pm SD was 24.7 \pm 9.8) Among them there were 11 male (18.3%) and 49 female (81.7%) participants (Table 1).

Table 1: Demographic information of the participants (n=147)

Variable	Clinical		Non-clinical		Total	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Gender						
Male	44	50.6%	11	18.3%	55	37.4%
Female	43	49.4%	49	81.7%	92	62.5%
Age (years)						
18-33	70	80.5%	52	86.7%	122	82.9%
34-49	16	18.4%	4	6.7%	20	13.6%
50-65	1	1.1%	4	6.7%	5	3.4%
Marital Status						
Married	43	49.4%	12	20.0%	55	37.4%
Unmarried	42	48.3%	47	78.3%	89	60.5%
Divorced	2	2.2%	1	1.7%	3	2.0%
Religion						
Hindu	9	10.3%	7	11.7%	16	10.8%
Muslim	76	87.4%	52	86.7%	128	87.0%
Buddhist	1	1.1%	1	1.7%	2	1.3%
Christian	1	1.1%	0	0%	1	0.6%
Education						
Primary	2	2.3%	0	0	2	1.3%
Secondary	21	24.1%	0	0	21	14.2%
Higher secondary and honors	44	50.6%	53	88.3%	97	65.9%
Masters	20	23%	7	11.7%	27	18.3%
Occupation						
Unemployed	30	34.5%	25	41.7%	55	37.4%
Service	20	23.0%	9	15.0%	29	19.7%
Business	8	9.2%	0	0.0%	8	5.4%
Others	29	33.3%	26	43.3%	55	37.4%
Socioeconomic status						
Lower class	6	6.9%	1	1.7%	7	4.7%
Lower middle class	29	33.3%	22	36.7%	51	34.7%
Middle class	46	52.9%	35	58.3%	81	55.1%
Higher class	6	6.9%	2	3.3%	8	5.4%
Residential area						
City	72	82.8%	50	83.3%	122	83.0%
Village	13	14.9%	10	16.7%	23	15.6%
Moholla	2	2.3%	0	0.0%	2	1.3%
Total	87	100%	60	100%	147	100%

The EFA, using the maximum likelihood extraction method, was used to identify the latent dimensions of the 44 five-point Likert-scale items measuring the anxiety disorder among people in Bangladesh. The Kaiser-Meyer-Olkin (KMO) and Bartlett's test of sphericity analyses in the preliminary principal component analysis (PCA) signify the sampling adequacy as the KMO value was 0.775, higher than the benchmark 0.600,^{38,39} and Bartlett's test of sphericity was also significant ($\chi^2[946]=2421.145$, $p < 0.001$). The decision to determine the number of factors was

guided by three decision rules, including the Kaiser's criterion, the Cattell's scree plot test and Horn's parallel analysis.^{40,41} The Kaiser's criteria based on eigenvalues were inconclusive as it suggests 13 components with an eigenvalue of 1 and above. The scree plot test endorses a two-factor solution by accepting the higher scree and ignoring the lower scree.⁴² The utility or acceptability of the two-factor solution was further assessed by comparing the eigenvalues from the PCA with the eigenvalues generated from the same size of random data set, where the

factors with the eigenvalues exceeding the values from randomized data were retained for analysis.^{43,44} The parallel analysis recommends a three-factor solution. However, (i) pattern coefficients >0.50 on one item for practical significance³⁸, (ii) e³ items with salient pattern coefficients and an internal consistency of e^{0.70} was considered for a meaningful and consistent factor structures^{45,46} and thus, the third factor was dropped for not meeting the criteria. Finally, to minimize the number of trivial factors from rotating, components with a minimum eigenvalue of 3.0 were subjected for the orthogonal rotation approach.⁴⁷ Based on the above-mentioned criteria, a two-factor solution was retained from the EFA. The KMO for the two-factor solution was 0.836 with Bartlett's test of sphericity of $\chi^2[136]=732.203, p < 0.001$ (Table 2). Factor 1 was labeled as social factor, whereas factor 2 was labeled as physiological factor. Because, Factor 1, social factor explaining 39% of the total variance with an excellent internal consistency ($\alpha=0.901$), entailed the items associated with social components related items, including 43, 42, 44, 33, 32, 31, 28, 29, 40, 30 and Factor 2 physiological factor with an internal consistency of 0.838 explaining 14% variance, referred to the items more with physiological components, including 4, 3, 5, 14, 13, 21, 17. Hence, we retain a two-factor measurement of anxiety disorders, explaining 53% of the total variance with the overall reliability of $\alpha=0.899$, indicates that the measurement could be applicable for other similar studies as the short version of R-AS, B.

Table 2: Exploratory factor analysis (n=87)

Items	Factor	
	Social factor	Physiological factor
RA_43	0.865	
RA_42	0.770	
RA_44	0.744	
RA_33	0.739	
RA_32	0.716	
RA_31	0.604	
RA_28	0.567	
RA_29	0.556	
RA_40	0.512	
RA_30	0.508	
RA_4		0.707
RA_3		0.698
RA_5		0.655
RA_14		0.617
RA_13		0.614
RA_21		0.580
RA_17		0.542
α	0.901	0.838

Based on the findings on the items of the RAS, B we executed the CFA by creating a two-factor model (Model 1 in Figure 1) with the corresponding items of the measure. The CFA of Model 1, presented in Table 3, shows that the fit indices were not within the acceptable limit ($\chi^2_{[118, N=87]}=212.144, p < 0.001$; SRMR=0.086 [< 0.08]; CFI=0.857 [> 0.95]; TLI=0.835 [$e^0.90$]; RMSEA=0.096 [> 0.06]).^{48,49} The SRMR indicates an acceptable fit, however, the CFI, TLI and RMSEA were not within the acceptable limits. The covariance in the modification indices suggests errors between item 43 and 42 in the Factor 1, and between item 4 and 3. After correlating the abovementioned error variances (Model 2 in Figure 2), the CFA of Model 2 suggest an excellent fit of all the indices ($\chi^2_{[116, N=87]}=164.091, p = 0.002$; SRMR=0.075 [< 0.08]; CFI=0.997 [> 0.95]; TLI=0.914 [$e^0.90$]; RMSEA=0.069 [> 0.06]). The standardized estimates of factors suggest that the factor loadings were relatively better in Model 1 (ranging from 0.58 to 0.84) compared to Model 2 (ranging from 0.59 to 0.80). However, the factors loading of Model 2 suggest some better psychometric properties of the short version of R-AS, B than Model 1. The 17 items R-AS, B subsequently validated by calculating the AVE and CR (Table 4). The values of AVE (> 0.40) and CR (> 0.60) of the R-AS, B ensure adequate construct validity.^{37,38,50}

Table 3: Goodness of fit indices from CFA to test the suitability of R-AS, B

Model	CFI	TLI	RMSEA (90% CI)	SRMR
1	0.857	0.835	0.96 (0.075-0.117)	0.086
2	0.927	0.914	0.069 (0.043-0.093)	0.075

Model 1 signified the baseline model; Model 2 error variances of items 43 and 42 in Factor 1, and items 4 and 3 in Factor 2 were correlated.

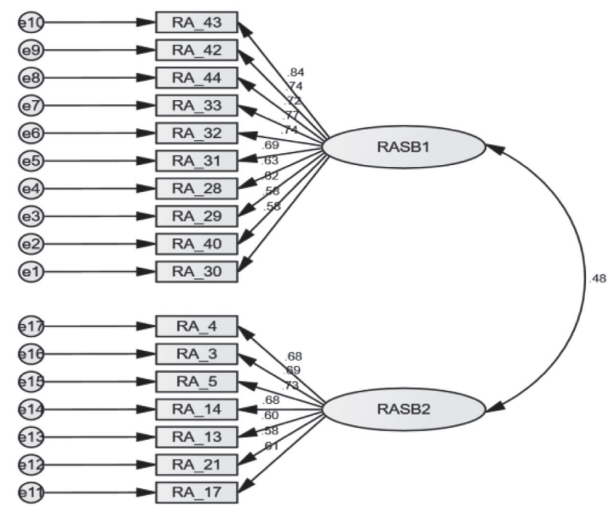


Figure 1: Baseline model-1 with no correlation among covariance

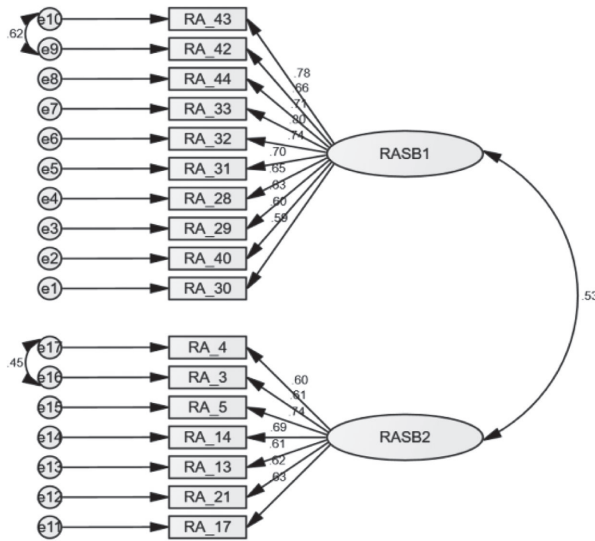


Figure 2: Model 2 with correlations among covariance

Table 4: Measurement of model validity and reliability

Component	Average variance extracted	Construct reliability
Factor 1	0.42	0.88
Factor 2	0.40	0.82

AVE = average variance extracted; CR =construct reliability

In split half reliability all items of the R-AS, B are randomly divided into two parts then the consistency between these two halves was measured.⁵¹ In this present study the split-half reliability coefficient was calculated on the scores obtained by the total 147 subjects. It was calculated through SPSS-20 version. The 17 items were splitted into two parts (9 items in part 1 and 8 items in part 2). The correlation between the two forms, Guttman split-half correlation, equal length spearman-Brown correlation, and

unequal length spearman-Brown correlation, coefficient alpha for part 1 and part 2 were calculated and all values are given in table 5 and all are significant at 0.01 level. The Pearson correlation coefficient for odd and even numbers items of 147 subjects (clinical and non-clinical) was found 0.930, which was significant at 0.01 levels. The split-half reliability determined on the present study presented in table- 5.

Coefficient alpha was a general formula for estimating reliability of a test consisting items in which two or more scoring are assigned to answers.^{52,53} The Cronbach alpha was found 0.93 for 17 items of the short version of R-AS, B. The revised anxiety scale³³ was administered two times within 2 to 3 weeks' interval on a sample of 60 non-clinical adult participants. The test retest correlation was calculated by determining the Pearson's correlation between these two responses. The coefficient of stability ($r=0.451$) was found to be significant at 0.01 level. Concurrent validity was achieved when a test yields same result as another valid test used for similar purposes.⁵² For estimation of concurrent validity, basically three external criterions were used e.g. a) psychiatrist rating, b) patient's self-rating, and c) scoring on a criterion measures. In this present study we only used scoring on a criterion measure (DASS-21). Scoring on a criterion measure (DASS 21) used to estimate the concurrent validity of current short version of R-AS, B, correlation between total score of the scale and DASS-21 obtaining from administering concurrently on 87 diagnosed anxiety subjects. The short version of R-AS, B was found positively correlated with each other (Pearson correlation $r=0.787$; at $\alpha=0.01$). Correlation of the short version of R-AS, B with the subscales of DASS 21 were as follows, $r=0.653$; at $\alpha=0.01$ for depression subscale, $r=0.717$; at $\alpha=0.01$ for anxiety subscale, and subscale $r=0.712$; at $\alpha=0.01$ for stress. This correlation coefficient indicates that it has a strong positive linear correlation. The discrimination capacity of this scale was tested on 147 participant (87 Clinical and 60 non clinical participants) using one way ANOVA. It was assumed

Table 5: Result of split-half correlation coefficient on 87 clinical and 60 non-clinical subjects (n=147)

Parts of scale	Number of items	Mean	Std dev	Guttman split half	Correlation between forms (part 1 and 2)	Spearman -Brown corrected correlation		Alpha	Pearson correlation coefficient of odd and even items
						Equal length	Unequal length		
Part - 1	9	15.55	9.714			.833	.834	.907	.930**
Part - 2	8	15.73	9.383	.833	.714			.913	

**Significant at the level of 0.01.

the scale will be able to discriminate clinical and non-clinical clients clearly. Result indicates that revised anxiety scale could discriminate between anxious and non anxious participants satisfactorily ($F=114.74$, $DF=1$ at $\alpha=0.01$). The mean and standard deviation of clinical and non clinical participants were shown in table 6.

Table 6: Mean and SD difference of clinical and non-clinical subjects (n= 147)

R-AS, B	Mean	SD
Total	31.28	17.68
Clinical	41.01	14.57
Non-clinical	17.18	17.73

Two types of norms was calculated for this scale a) Severity norm and b) Screening norm. So, the scores obtained by the 147 participants were used to determine the severity and screening norm for the short R-AS, B. To develop scale severity norm, raw scores (minimum=6 to maximum=67) on short version of R-AS, B, obtained by total 87 clinical participants were converted to percentile rank. Four levels of severity, i.e., mild, moderate, severe and profound were decided based on the scores. Subsequent percentile and scale scores are presented in (Table 7).

Table 7: Severity norm and its percentile rank of clinical samples (n=87)

Severity of anxiety	Corresponding percentile	Corresponding scores of revised anxiety scale
Mild	0-25	0-30
Moderate	26-50	31-43
Severe	51-75	44-53
Profound	76 and above	54 and above

The screening norm of the short version of R-AS, B, was calculated using ROC curve analysis on the total 147 participants. In the ROC curve analysis, it found that area under the curve equals 0.89 significant 0.01 levels and 95% confidence interval upper bound 0.83 and lower bound 0.94. Using the ROC Curve analysis we found sensitivity 0.9 and specificity 0.7. Based on this sensitivity and specificity cut off point is closed to 19.50. Within the cut of score there was error chance of 10% anxious individual will be detected as non-anxious and 36% non-anxious individual will be detected as anxious.

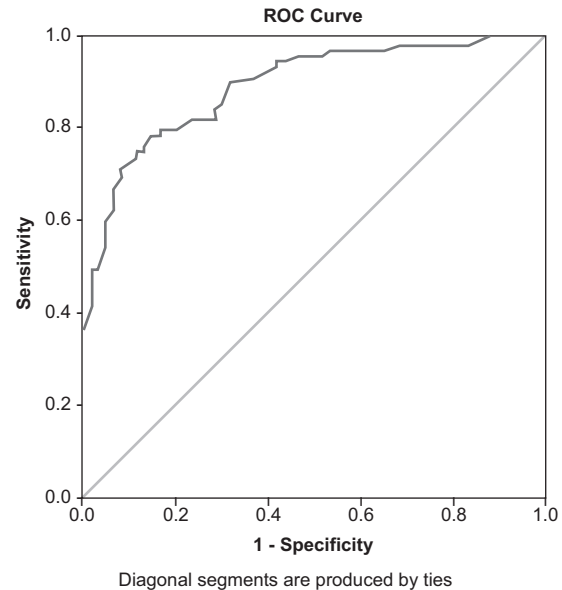


Figure 3: ROC Curve of sensitivity and specificity and cutoff point

Discussion

Our study was intended to shorten the revised anxiety scale developed for Bangladeshi population (R-AS, B)³³ to obtain a reliable, valid and culturally sensitive quickly usable measure for clinical and research purposes by the mental health professionals and relevant researchers of the country. The EFA analysis yielded a 17-item construct, which was then supported through the CFA. The nature of the social and psychological construct within trajectory of the anxiety disorder for the Bangladeshi population was very relevant. Generally anxiety was related to any social context and its reaction was manifested physiologically. So anxiety symptoms were expressed through social and physiological factors.⁵⁴ In this scale items, social and physiological factors were more dominating factors so others factors like cognitive and behavioral factors were not survived properly. In Asian countries, people generally manifested their anxiety through physical reaction in any social situation and Bangladesh is one of them.⁵⁵

In reliability analysis we used internal consistency reliability and test-retest reliability. In internal consistency reliability, split-half reliability and Chronbach-alpha reliability was calculated. In reliability analysis we used different groups of people in different situations and different levels so this scale would be more reliable. This 17 items scale reliability was relatively similar to 36 items anxiety scale and 40 items revised anxiety scale. This reliability indicated that, this scale had good internal consistency reliability and it was well deserved. After strictly following scale construction model expert judge evaluation scale was constructed this indicated that scale's had good content validity.

Through the F test and others mean and standard deviation it also found that this scale could differentiate clinical and non-clinical participants.

Two types of norms were calculated severity norm and screening norm. Severity norm found mild (0-30), moderate (31-43), severe (44-53) and profound (54 and above). Screening norm was calculated using ROC curve analysis and found 19.5 as cut off point. Within this cut off point, this scale had a 10% chance to identify anxious person as non-anxious and 36% non-anxious person as anxious. Within these limitations, this scale had 90% possibility of identifying real anxious cases. This measure would be most useful for clinical case identification as well as measuring anxiety severity and research purpose also.

Conclusion

From the above discussion, it could be said that, this short version revised anxiety scale Bangla (R-AS, B) is a psychometrically sound assessment tool. Besides these it has some limitations, like, not being tested on large data, we could not do the multi-group analysis or the nature of response based on demographic matters. Though data is collected from only Dhaka city, so this scale cannot fully represent the whole Bangladeshi population. It would be better if we could collect data from the entire country. Finally this scale can be only used for clinical or research purposes and identifying anxiety but it can not be used for diagnosing anxiety disorders.

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