

**Psychometric Properties of the Chinese Version of the Eating
Attitudes Test (EAT-26) in Young Female Patients with Eating
Disorders in Mainland China**

Qing Kang¹, Raymond C. K. Chan^{2,3}, Xiaoping Li⁴, Jon Arcelus⁵, Ling Yue¹, Jiabin Huang¹, Lian Gu¹, Qing Fan¹, Haiyin Zhang¹, Zeping Xiao^{1#} & Jue Chen^{1#}

¹Department of Clinical Psychology, Shanghai Mental Health Center, Shanghai Jiao Tong University School of Medicine, Shanghai, China

²Translational Neuropsychology and Applied Cognitive Neuroscience Laboratory, Shanghai Mental Health Center, Shanghai Jiao Tong University School of Medicine, Shanghai, China

³Neuropsychology and Applied Cognitive Neuroscience Laboratory, Key Laboratory of Mental Health, Institute of Psychology, Chinese Academy of Sciences, Beijing, China

⁴Psychological Measurement Room, Shanghai Mental Health Center, Shanghai Jiao Tong University School of Medicine, Shanghai, China

⁵Institute of Mental Health, Faculty of Medicine & Health Sciences, University of Nottingham, Nottingham, United Kingdom

#: Corresponding authors: Zeping Xiao, Jue Chen

E-mail: Zeping Xiao, xiaozeping88@163.com, Department of Clinical Psychology, Shanghai Mental Health Center, Shanghai Jiao Tong University School of Medicine, 600 Wan Ping Nan Road, Shanghai, China

E-mail: Jue Chen, chenjue2088@163.com, Department of Clinical Psychology, Shanghai Mental Health Center, Shanghai Jiao Tong University School of Medicine, 600 Wan Ping Nan Road, Shanghai, China

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Abstract

The study aimed to investigate the reliability and validity of the Chinese version of the EAT-26 among female adolescents and young adults in Mainland China. This scale was administered to 396 female EDs patients and 406 non-eating disorder healthy controls (HC), in addition 35 HC completed a retest after a 4-week intervals. Tests for reliability, convergent validity and ROC analysis were performed to detect the psychometric properties. The EAT-26 demonstrated good internal consistency (Cronbach alpha=0.822~0.922), test-retest reliability (ICC=0.817), and convergent validity ($r=0.450\sim0.750$). The ROC analysis showed that the cutoff 14 for AN and 15 for BN represented good compromises with approximate sensitivity (0.66~0.68) and specificity (0.85~0.86). Our findings provided evidence that the Chinese version of the EAT-26 was a psychometrically reliable and valid self-rating instrument for identifying people suffering from an ED in Mainland China. A clinical cutoff range between 14 and 15 could be used but caution should be exercised due to the low sensitivity of the tool.

Keywords: EAT-26; eating disorder; psychometric properties; cutoff, Mainland China

Introduction and aims

Eating disorders (EDs) have been found to affect young females particularly (Hudson, Hiripi, Pope, & Kessler, 2007) and to be common in developed countries (Dolan, 1991). In addition EDs and weight concerns are becoming more prevalent in developing China (Huon, Qian, Oliver, & Xiao, 2002; Lee, S., & Lee, A. M., 2000; Tong *et al.*, 2014).

A number of assessment tools for EDs have been developed to be used in clinic and research settings and some of them have been translated in order to be used in China, such as the Eating Attitudes Test 26-item version (EAT-26) (Garner, Olmsted, Bohr, & Garfinkel, 1982; Lee, Kwok, Liao, & Leung, 2002), the Eating Disorder Examination (EDE) (Tong *et al.*, 2011), or the Eating Disorder Inventory (EDI-1) (Garner, Olmstead, & Polivy, 1983; Zhang, W. H., Zhang, D. R., & Qian, 2006). Although the EDE and EDI-1 have demonstrated to have good validity and reliability among the Mainland Chinese EDs population (Tong *et al.*, 2011; Zhang & Kong, 2004), they are limited by their length. This makes them unsuitable to be used in primary care settings. However, the EAT-26, a widely used self-report instrument, has already been used successfully to screen EDs patients in Hong Kong, China (Lee *et al.*, 2002; Lee, S., & Lee, A. M., 2000). The results of these studies showed differences in EDs symptomatology between people from Hong Kong and Mainland China, suggesting the need to re-establish the validity and reliability of EAT-26 in female EDs population in Mainland China.

The EAT-26 (Garner *et al.*, 1982) is one of the most empirically supported and oldest self-report instruments used to identify people suffering from an ED. A clinical cutoff of 20 was initially established which was found to offer the best compromise between sensitivity (1.00) and

specificity(0.91)(King, 1986). A more recent American study confirmed that this cutoff had a diagnostic accuracy rate of 90% with a similar specificity (0.94) but a lower sensitivity(0.77)(Mintz & O'Halloran, 2000).Over the years a large body of literature has investigated the psychometric properties of the EAT-26 in different(primarily Western) cultures and among clinical and community samples(Garfinkel & Newman, 2001; Al-Adawi, Dorvlo, Burke, Moosa, & Al-Bahlani, 2002; Lee *et al.*, 2002; Nunes, Camey, Olinto, & Mari, 2005; Siervo, Boschi, Papa, Bellini, & Falconi, 2005; Rivas, Bersabé, Jiménez, & Berrocal, 2010).However, there are some inconsistencies regarding the cutoffs suggested by the findings of these studies. For example, an Italian study found that a clinical cutoff of 10 (instead of 20) was more appropriate to differentiate clinical from non-clinical people among the Italian population they studied (Siervo *et al.*, 2005). These studies suggest that the clinical cut off may be influenced by the target population.

As research suggested that EDs are increasingly prevalent in Mainland China(Lee, S., & Lee, A. M., 2000; Gail, Qian, Kylie, & Guanglan, 2002; Tong *et al.*, 2014), having a validated diagnostic tool for this population is important. In addition, as a recent study has demonstrated differences in the presentation of people with AN between Western and non-Western societies(Agüera *et al.*, 2017), these instruments need to be validated for the Chinese population. Lee *et al.* (2002) proposed that a clinical cutoff of 20 would lead to an underestimation of atypical AN in community surveys in Hong Kong(Lee *et al.*, 2002) and they found the mean of EAT-26 score(18.4) of AN patients was less than 20. However, Hong Kong is an international metropolis with similar socio-cultural values to western countries. This will indicate that the psychometric data provided by EDs samples in Hong Kong and other Western societies may not apply to Mainland Chinese EDs population.

In view of this, the aim of the current study was to investigate the reliability, validity and clinical cutoff of the Chinese version of the EAT-26 (Lee *et al.*, 2002; Lee *et al.*, 2002) among female adolescents and young adults in Mainland China.

Method

Participants and Procedure

The clinical EDs group consisted of 396 female patients, including 157 adolescents(13~18 years old) and 239 adults(18~29 years old). Every patient recruited in the study was born and lived in Mainland China, assessed at the Shanghai Mental Health Center and fulfilled a diagnostic criteria for an eating disorder (DSM-IV-TR)(APA, 2000). The study took place at the Clinical Psychology Department of the Shanghai Mental Health Center(SMHC, Shanghai, China) between January 2003 to December 2015.

Using the DSM-IV-TR criteria, the clinical group consisted of 230 patients who full fielded diagnostic criteria for anorexia nervosa (AN), 84 for bulimia nervosa (BN), and 82 for Eating Disorders Not Otherwise Specified (EDNOS). In view of the new version of the DSM (DSM-5, APA, 2013) and as previous studies (Brewin, Baggott, Duggart, & Arcelus, 2014) patients were re-diagnosed using the new classification system, the total clinical sample consisted of 240 patients with AN, 84 with BN, 28 with binge eating disorder (BED), and 44 with other specified feeding or eating disorder (OSFED). The re-diagnosis under DSM-5 was performed by the first author (QK), and reviewed independently by another author (JC). Both of the diagnoses and re-diagnoses were established by licensed psychiatrists experienced in eating disorders. The detailed way of re-diagnosing can be found in the supplementary material.

The non-clinical healthy control (HC) group consisted of 406 females, including 184 adolescents (13~18 years old) and 222 adults (18~29 years old). They were recruited from middle schools (n=72), high schools (n=132), universities (n=160) and jobholders (n=42) between June 2003 to December 2015 in Shanghai, China via advertisements. Every participant from the HC group was used the Chinese version of the Mini-International Neuropsychiatric Interview (M.I.N.I.) (Pinninti, Madison, Musser, & Rissmiller, 2003; Si *et al.*, 2009) to screen and confirm without an ED or any other psychiatric diagnosis.

Both groups, if agreed participation, completed a battery of questionnaires. The test-retest assessment was performed in the HC group only, as the EAT-26 scores in the EDs group could change during a 4-week intervals treatment, and influence the accuracy of the test-retest reliability. Finally 35 HC voluntarily completed the EAT-26 twice at a 4-week intervals.

The study was approved by the Local Ethics Committees at the Shanghai Mental Health Center. A consent form was signed by participant above the age of 18 years and by the parents of those below 18 years, who agreed participation.

Measures

1. The Chinese version of the Eating Attitudes Test 26-item version (EAT-26) (Garner *et al.*, 1982; Lee & Lee, 1996)

The Eating Attitudes Test 26-item version (EAT-26) is a widely used self-rating questionnaire that assesses disturbed eating attitudes and behaviors (Garner *et al.*, 1982). The answer for each item uses a 6-point likert score system (range 0=never to 5=always) which are grouped into 4-point format (0=never, rarely and sometimes, 1=often, 2=usually, 3=always), total scores can range from

0 to 78. The Chinese version of the EAT-26 was provided by Lee (Lee *et al.*, 2000; Lee *et al.*, 2002).

As four different factor models of the EAT-26 have been reported in China (Lee *et al.*, 2000) and even more models have been proposed in different cultures (Garfinkel *et al.*, 2001), we used the EAT-26 total score rather than subscale scores to conduct the analysis.

2. The Chinese version of the Eating Disorder Inventory-I (EDI-I) (Garner, Olmstead, & Polivy, 1983; Zhang, W. H., Zhang, D. R., & Qian, Y., 2006)

The EDI-I is a 64-item self-report instrument that is designed for the assessment of psychological and behavioral symptoms of ED (Garner *et al.*, 1983). Each item is scored on a 3-point scale. The EDI-I has 8 subscales: Drive for thinness, Bulimia, Body dissatisfaction, Ineffectiveness, Perfectionism, Interpersonal distrust, Interoceptive awareness, and Maturity fears. The EDI-I was used to assess the convergent validity of the EAT-26 in our study. The Chinese version of the EDI-I has demonstrated good psychometric properties in clinical and non-clinical groups in Mainland China (Zhang *et al.*, 2006). The Cronbach's alpha for the present ED and HC groups were 0.911 and 0.814 for the total scale, respectively.

3. The Chinese version of the Mini-International Neuropsychiatric Interview (M.I.N.I.) (Pinninti *et al.*, 2003; Si *et al.*, 2009)

The M.I.N.I. is a structured diagnostic interview schedule that was developed to assess the diagnoses of psychiatric patients (Pinninti *et al.*, 2003). The M.I.N.I. was used to screen for EDs and other psychiatric disorders among all the participants in the current study. The Chinese version of the M.I.N.I. has good validity and reliability according to Si *et al.* (2009) in Mainland China (Si *et al.*, 2009).

Data Analysis

The data were analyzed using SPSS 21.0(IBM Corporation, Armonk, New York, U.S.A.). Independent t-tests, analysis of variance (ANOVA) and analysis of covariance (ANCOVA) were used for continuous variables. Two-tailed significance levels were set at $p<0.05$. Bonferroni correction was applied when multiple comparisons occurred.

Cronbach's alpha and interclass correlation coefficient (ICC) over 4-week intervals were used to examine the internal consistency and test–retest reliability of the EAT-26, respectively. An ICC of at least 0.75 indicates an acceptable level (Weir, 2005). Pearson correlations with EDI-I total score were conducted to evaluate the convergent validity.

A receiver operating characteristic (ROC) analysis was calculated to assess the different cutoffs between sensitivity and specificity in discriminating ED patients from controls. Area under the curve (AUC) values, sensitivity, specificity, and the Youden index(YI) were reported in the text. An AUC value of 0.50~0.70 is considered fair, an AUC of 0.70~0.90 is good, and an AUC>0.90 is excellent (Swets, 1988).

Results

Demographical Characteristics of All Participants

The demographic data are summarized in **Table 1** and **sTable 1**. Compared with HC, EDs patients were older and had lower BMI (all $p<0.05$). When age was controlled for as a covariate, the ANCOVA also showed lower BMI in the EDs group ($p<0.05$).

Insert table 1 around here

Differences in the Means of Total EAT-26 Scores by Group

Participants in the EDs group had significantly higher EAT-26 total scores than did those in the HC group ($t=20.109$, $p<0.001$). Bonferroni post hoc tests showed that the scores of most of the groups differed significantly from one another: Patients with BN had the highest scores, and HC controls had the lowest scores. Likewise, when the age was controlled as a covariate, the statistical difference in the total EAT-26 score among subgroups were in accordance with the above results: the BN group was the highest, and the HC group was the lowest(see **Table 1**).

Reliability

Internal Consistency

The internal consistency of the EAT-26 was assessed with Cronbach's alpha, and the results revealed satisfactory levels for all groups. Cronbach's alphas for the EAT-26 total scores for the EDs, AN, BN, BED, OSFED, and HC groups were 0.910, 0.915, 0.879, 0.919, 0.822, and 0.830, respectively.

Test-retest Reliability

As stated above, 35 HC completed the retest after 4-week intervals. At the first self-evaluation, the total EAT-26 score ranged from 0 to 19 ($mean=5.43$, $SD=5.19$). At the retest stage, it ranged from 0 to 22 ($mean=4.83$, $SD=4.97$). Test-retest reliability was good ($ICC=0.817$, $p<0.001$). A paired-sample t test showed no significant differences between the test and retest scores for the total EAT-26($t=0.54$, $p=0.593$). In addition, we compared the mean age, BMI, and total EAT-26 score

between the respondents ($n=35$) and non-respondents ($n=351$) for the test-retest analysis, and the results showed no difference in these variables between the two groups (all $p>0.05$).

Convergent Validity

Convergent validity was analyzed with Pearson correlations between the total EAT-26 scores and EDI-I scores, and the results revealed significant moderate to large correlations in all groups (see **Table 2**). The correlations between the total scores of EAT-26 and EDI-I for the EDs, AN, BN, BED, OSFED and HC groups were 0.744, 0.743, 0.567, 0.450, 0.661 and 0.513, respectively (all $p<0.001$).

ROC Analysis for the Sensitivity and Specificity of the EAT-26

For the EDs group, according to the highest YI (0.524), the cutoff of 15 provided the best compromise between sensitivity (0.66) and specificity (0.86), and the AUC was 0.833 (95%CI: 0.807, 0.806). For the AN and BN groups, the calculated optimal cutoffs were 14 and 15, respectively. Summarily, the cutoff range from 14 to 15 yielded approximate sensitivity (0.66~0.68), specificity (0.85~0.86) and YI to differentiate EDs (including AN and BN) patients from non-clinical populations. The performance of other possible cutoffs reported in previous studies, ranging from 10 to 23 were presented in **Table 2** (King, 1986; Al-Adawi *et al.*, 2002; Rivas *et al.*, 2010).

Insert table 2 around here

Discussion

The present study assessed the cross-cultural clinical utility of the Chinese version of the EAT-26 among females with EDs in Mainland China. The results demonstrated that the Chinese version of the EAT-26 was a psychometrically reliable and valid self-report instrument for this population.

The reliability and validity analyses of the EAT-26 revealed sufficient internal consistency and convergent validity for the different ED sub-diagnoses. The test-retest reliability of this scale was very good. The result of sufficient internal consistency was consistent with the findings of previous studies (Lee *et al.*, 2002; Nunes *et al.*, 2005). The results also supported good convergent validity among female adolescents and young adults in Mainland China.

The cutoff 14 and 15 were found to be appropriate to differentiate people with clinical AN and BN from HC with sensitivity(0.67; 0.79) and specificity(0.82; 0.86) in our sample, respectively. According to the highest YI for the total EDs group, the optimal cutoff was 15(0.524), and the cutoff 14 and 15 had similar YIs. This suggests that the cutoff for clinical ED range between 14 and 15 as this will provide enough sensitivity and specificity to differentiate EDs patients from HC. Furthermore, all three areas under the ROC curves (AUCs) in the three groups were greater than 0.80, suggesting sufficient discriminatory ability of the EAT-26 in our clinical samples.

Despite the optimal cutoff points with acceptable AUCs in the current study, the results for sensitivity were not satisfactory. In general, the sensitivity found (0.663~0.793) was less acceptable than the specificity (0.818~0.861) among the EDs, AN and BN groups. Different clinical cutoffs have provided different results regarding sensitivity, and specificity in the literature. For example, a clinical cut off of 20 from the English version has a sensitivity of 1.00 and specificity of 0.91 (King, 1986), a lower cutoff of 10 from the Arabic version of the EAT-26 has a sensitivity of 0.64 and a

specificity of 0.38 (Al-Adawi *et al.*, 2002), and a cutoff of 23 from the Spanish version has a sensitivity of 0.60 and a specificity of 0.95 (Rivas *et al.*, 2010).

Two possible explanations can be considered for the different findings of our study when comparing with previous reports. Firstly, the sample composition of prior studies was different in culture, age, gender, which may result in different values. For example, some surveys were conducted on females only while others in both genders (Al-Adawi *et al.*, 2002, Nunes *et al.*, 2005), and some samples consisted of patients with EDs as one group (King, 1986) while others focused on specific ED diagnosis and community controls (Siervo *et al.*, 2005). Secondly, the social and culture difference between studies could play important roles in the inconsistency in their findings. The EAT-26 total scores of the EDs patients in our study ($mean=23.70$, $SD=16.00$) was smaller than those in Western patients ($mean=31.23$, $SD=12.39$) (Mintz *et al.*, 2000). This may contribute to a smaller cutoff of the EAT-26 in our sample compared with the Western.

The distribution of total scores among subsamples (AN, BN, and HC) was approximately equivalent to the data reported by Lee *et al.* (2002) (Lee *et al.*, 2002), but differed from reported results from non-Asian populations (Garfinkel *et al.*, 2001). People from China had lower total scores than non-Asians populations, perhaps because people from Asian are encouraged on a socio-cultural basis to use denial and minimization in coping with psychiatric disorders (Lee & Lock, 2007).

This study had several limitations, such as the fact that EDs people were older than HC, although this variable was controlled for, or the fact that only a small number of participants completed the retest and test-retest reliability examination. As the sample included young female

participants only in view of the small number of male ED patients attending services during the study period(only 10). Therefore, the results may not be able to be generalized to male or older people with ED.

Despite the above limitations, a major and clear strength of the present study may be its clinical sample size. Our findings provided evidence that the Chinese version of the EAT-26 is a psychometrically reliable and valid self-rating instrument to identify people suffering from an ED in Mainland China. A clinical cutoff range between 14 and 15 could be used but caution should be exercise due to the low sensitivity.

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Table 1. The demographic and clinical characteristics of all participants (n=802)

	mean (SD)						All ED vs. HC(<i>t/p</i>)
	All ED	AN	BN	BED	OSFED	HC	
n	396	240	84	28	44	406	
Age(years)	19.62(4.53)	18.83(4.37)	22.46(5.38)	19.67(5.30)	18.95(4.35)	18.35(2.67)	5.009**
Onset age(years)	16.93(3.06)	16.50(2.84)	18.73(4.18)	16.94(2.69)	15.48(2.99)	--	--
DOE(months)	32.24(34.20)	26.77(29.40)	42.73(37.12)	53.59(52.89)	39.38(49.82)	--	--
BMI	16.24(3.09)	15.28(2.11)	19.52(2.49)	20.74(2.52)	14.79(2.30)	20.25(2.74)	-18.760**
EAT-26	23.70(16.00)	22.65(15.87)	31.04 (14.52)	17.04(14.06)	13.81(10.42)	7.22(7.85)	20.109**

Note: ** $p < 0.001$. AN=anorexia nervosa, AN-R= anorexia nervosa of restricting subtype, AN-BP= anorexia nervosa of bulimia/ purging subtype, BMI=body mass index, BN=bulimia nervosa, DOE= Duration of eating disorder, ED= eating disorder, EAT-26= total score of twenty-six items eating attitude test, HC= healthy control, OSFED=other specified feeding or eating disorder

Table 2. The ROC analysis for the cutoffs, sensitivity, specificity and Youden index of the total EAT-26 scores for the ED, AN, and BN groups

Cutoffs	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
EDs	Sensitivity	0.770	0.760	0.727	0.699	0.676	0.663¹	0.643	0.615	0.589	0.561	0.526	0.500	0.477	0.454
	Specificity	0.731	0.763	0.786	0.816	0.847	0.861	0.879	0.888	0.897	0.907	0.918	0.923	0.932	0.939
	YI	0.501	0.523	0.513	0.515	0.523	0.524	0.522	0.502	0.486	0.469	0.444	0.423	0.409	0.393
AN	Sensitivity	0.763	0.755	0.727	0.691	0.667	0.651	0.631	0.610	0.574	0.534	0.490	0.466	0.434	0.418
	Specificity	0.704	0.736	0.760	0.789	0.818	0.832	0.851	0.860	0.870	0.880	0.892	0.897	0.906	0.916
	YI	0.467	0.491	0.487	0.480	0.485	0.483	0.482	0.470	0.444	0.414	0.382	0.363	0.340	0.334
BN	Sensitivity	0.901	0.883	0.847	0.829	0.802	0.793	0.775	0.721	0.712	0.712	0.694	0.658	0.649	0.613
	Specificity	0.731	0.763	0.786	0.816	0.847	0.861	0.879	0.888	0.897	0.907	0.918	0.923	0.932	0.939
	YI	0.632	0.646	0.633	0.645	0.649	0.654	0.654	0.608	0.608	0.619	0.612	0.581	0.581	0.552

Note: ¹: All letters marked in bold means the best-fitting cutoffs according to the Youden indices.

ED= eating disorder group, AN=anorexia nervosa group, BN=bulimia nervosa group, YI=Youden index= Sensitivity-(1 - Specificity)