

# Psychometric Evaluation of EMBU for Junior High School Students in Guangdong Province

Hou Yongmei\* Luo Jiaying

Department of Psychology, School of Humanity and Administration, Guangdong Medical University, Dongguan 523808, Guangdong Province, China

**Abstract:** *Objective* To analyze the psychometric performance of Egma Minnen av Bardndosnaupporstran (EMBU) for junior high school students in Guangdong Province. **Methods** Stratified random sampling method was used to select 1248 junior high school students from 6 middle schools in Guangdong province. EMBU was used to investigate them. Cronbach's  $\alpha$  coefficient and split-half reliability were used to analyze the internal consistency of the questionnaire. Convergent validity, discriminant validity and factor analysis were used to evaluate its structural validity. Floor and ceiling effect were used to evaluate its sensitivity. **Results** Cronbach's  $\alpha$  coefficient of the total questionnar was 0.933, and the Cronbach's  $\alpha$  coefficients of Father's and Mather's subscale were 0.896 and 0.902, respectively, which met with the requirements of the group comparison. Spearman-Brown split-half coefficient of the total questionnar was 0.947, and Spearman-Brown split-half coefficients of Father's and Mather's subscale were 0.858 and 0.887, respectively. The calibration success rates of convergent validity of 11 dimensions were all above 81.3%. The calibration success rates of discriminant validity of 11 dimensions were all above 90.0%. Six factors were extracted from Father's subscale and five factors were extracted from Mather's subscale, with the cumulative variance contribution rates of 61.118% and 64.007%, respectively, which basically met the theoretical conception of EMBU. The score distribution of each dimension was governed by a normal distribution, without any floor or ceiling effect. **Conclusions** The psychometric performance of EMBU for junior high school students in Guangdong was valid and reliable.

**Key words:** Parental Rearing Pattern; Junior High School Students; Reliability; Validity; Sensitivity

Parental rearing style is the collection of emotional atmosphere expressed by parents' attitude towards children and parents' behavior. This aggregate is a summary of the characteristics of various parenting behaviors of parents, reflecting the essence of parent-child communication. It is relatively stable and will not change easily with the change of situation [1].

Family is the first environment for individuals to contact after birth, and it is also a far-reaching factor affecting individual growth. Among them, the parental rearing style is the most important one. Parents are the first teachers and the most important others of their children. Parents' words and deeds play the role of demonstration, guidance, influence, catalysis and correction from the birth of their children. Good parental rearing style can lay the cornerstone of their children's mental health and promote the good development of their children's behavior, attitude, cognition, emotion, personality and other qualities, while bad parental rearing style is an important factor affecting the formation of some bad personality traits [2-5].

EMBU (Egma Minnen av Bardndosnaupporstran) is a scale compiled by Perris C et al (1980) [6] to evaluate parental rearing styles. Compared with similar scales, EMBU has the characteristics of large capacity and rigorous structure and can objectively and comprehensively reflect parental rearing behavior. It has been more and more widely used all over the world. Yue Dongmei et al. (1993) [7] revised EMBU into Chinese version. Since then, the scale has been widely used in many fields such as psychology, pedagogy, sociology and

psychiatry in China. However, we lack the report on the psychometric performance test of EMBU of Chinese version in recent 10 years.

Based on the above analysis, this study intends to take Guangdong Province as an example, using a large sample and multi center survey model to explore the psychometric performance of EMBU for junior high school students in Guangdong Province.

## I. Objects and Methods

### 1.1 Objects

#### 1.1.1 Sample Size Estimation

The minimum sample size is calculated by  $G * power^3$  [8]. Previous studies have shown that the test effect value of domestic research on parental rearing styles of junior high school students is at the medium level, that is, the D value is 0.50-0.80 [9-11]. In this study, we set the effect value  $d = 0.70$ , and the statistical test power of  $1 - \beta = 0.80$ , the type I error probability  $\alpha = 0.05$ . As there are 16 independent variables in this study, the minimum sample size required for the survey is calculated as 332. The minimum sample size is determined to be 415 due to a 20% of possible follow-up loss rate.

#### 1.1.2 Sampling

Stratified random sampling method is used to select 1260 junior high school students from Guangzhou, Zhanjiang and Shaoguan, Guangdong Province. 1248 valid questionnaires are collected, with an effective rate of 99.0%. The age ranged from 13 to 17 years old, with an average of  $(14.36 \pm 1.23)$  years old. Among them, there are 660 boys and 588 girls; 1039 only children and 209 non only children; 741 urban students and 507 rural students; 439 in grade 7, 417 in grade 8 and 392 in grade 9; 109 from wealthy families, 318 from well-off families, 521 from average families, 122 from families with financial difficulties and 178 from poor families.

### 1.2 Tools

#### 1.2.1 Egma Minnen av Bardndosnaupporstran, EMBU

EMBU is compiled by Perris C et al (1980) [6] and revised by Yue Dongmei et al. (1993) [7] into Chinese version. EMBU is composed of two subscales of Father's and Mother's subscales. Father's subscale includes 58 items, which are divided into six dimensions: emotional warmth and understanding, punishment and severity, excessive interference, preference for subjects, refusal to deny and overprotection; Mother's subscale includes 57 items, which are divided into five dimensions: emotional warmth and understanding, excessive interference and protection, refusal and denial, punishment and severity, and preference for subjects. The Likert 4-point scoring method is used to score from 1 to 4 points corresponding to "never" to "always". The higher the score, the stronger the tendency in this dimension (item).

#### 1.2.2 Self-compiled Personal Information Questionnaire

It includes 5 items, namely, gender, age, grade, origin and only child or not.

### 1.3 Data collection and sorting

The investigation method of centralized test is adopted. Before the investigation, the researchers participating in the survey are trained uniformly, and the investigation process and evaluation standard are unified. The consistency tests ( $\kappa = 0.81 - 0.90$ ) meet the requirements of psychometrics.

The questionnaires with answers of  $\geq 50\%$  of items missing are eliminated, and the missing values of the effective questionnaires are estimated and filled with the average. Two researchers input the same data independently with epidata3.0 software and conduct a unified logic check to ensure the accuracy of the data.

### 1.4 Data processing

Data are exported from epidata3.0 to SPSS 20.0 for statistical analysis. First, the original score of each dimension is calculated. The second step is to get the average score and standard deviation of each dimension.

In the third step, the floor and ceiling effect are evaluated, and then, Cronbach's  $\alpha$  coefficient and Spearman-Brown split half reliability are calculated. Finally, convergent validity, discriminant validity and principal component factor analysis are carried out.

## II. Results

### 2.1 The distribution of EMBU score

Ceiling / floor effect is a kind of psychological test effect, which refers to the phenomenon that when a task or test is too simple / complex, the scores of most subjects are close to or reach the upper/lower limit of scores, which makes the evaluation performance and prediction performance of the test reduce [12]. Table 1 shows that the scores of 11 dimensions tend to be governed by normal distribution, without any floor or ceiling effect.

**Table 1 Descriptive Analysis of 11 Dimensions of EMBU (n = 1248)**

Dimension item number	X $\pm$ s	Min	Max	P25	P50	P75	Floor[n(%)]	Ceiling[n(%)]	
FF1	19	42.89 $\pm$ 8.06	19.00	73.00	38.00	43.00	48.00	2 (0.4)	0(0)
FF2	12	26.74 $\pm$ 4.96	16.00	48.00	23.00	26.00	29.00	0(0)	1(0.2)
FF3	10	22.47 $\pm$ 4.25	10.00	37.00	20.00	22.00	25.00	6(1.1)	0(0)
FF4	5	12.19 $\pm$ 3.16	7.00	20.00	10.00	12.00	14.00	0(0)	3(0.6)
FF5	6	11.86 $\pm$ 3.33	6.00	24.00	10.10	12.00	14.00	3(0.6)	0(0)
FF6	6	12.79 $\pm$ 2.75	9.00	20.00	11.00	13.00	15.00	0(0)	2(0.4)
FM1	19	38.94 $\pm$ 7.89	19.00	70.00	34.00	39.00	43.00	4(0.8)	0(0)
FM2	16	31.76 $\pm$ 7.06	16.00	63.00	27.00	31.00	36.00	5(1.0)	0(0)
FM3	8	16.32 $\pm$ 3.64	8.00	28.00	14.00	16.00	19.00	11(2.1)	0(0)
FM4	9	18.28 $\pm$ 4.50	11.00	36.00	16.00	18.00	21.00	0(0)	2(0.4)
FM5	5	9.36 $\pm$ 2.68	5.00	20.00	8.00	9.00	11.00	23(4.4)	2(0.4)

### 2.2 Reliability analysis of EMBU

#### 2.2.1 Split half reliability

According to Sperman-Brown formula, the split half reliability of the total table is 0.947; The split half reliability of Father's and mother's subscale are 0.858 and 0.887, respectively. The split half reliability of the 11 dimensions are 0.891, 0.824, 0.651, 0.715, 0.766, 0.745, 0.916, 0.826, 0.795, 0.750 and 0.492, respectively.

#### 2.2.2 Internal consistency reliability

Cronbach's  $\alpha$  Coefficient is used to measure the internal consistency reliability of each dimension. Generally Speaking, When Cronbach's  $\alpha$  coefficient  $> 0.7$ , the internal consistency reliability is better. It can be seen from table 2 that there is a low to medium correlation between the dimensions. Cronbach's  $\alpha$  coefficient of the total scale is 0.933; Cronbach's  $\alpha$  coefficient of Father's subscale is 0.896, and Cronbach's  $\alpha$  coefficients of FFI – FF6 are 0.859, 0.755, 0.702, 0.715, 0.736 and 0.540, respectively; Cronbach's  $\alpha$  coefficient of Mother's subscale is 0.902, and Cronbach's  $\alpha$  coefficients of FM1-FM5 are 0.827, 0.853, 0.753, 0.705 and 0.658, respectively.

**Table 2 Cronbach's  $\alpha$  Coefficient and Correlation Coefficient of Each Dimension**

Dimension	Cronbach's $\alpha$	1	2	3	4	5	6	7	8	9	10	11
1.FFI	.859											
2.FF2	.755	.66**										
3.FF3	.702	.67**	.62**									
4.FF4	.715	.67**	.51**	.48**								
5.FF5	.736	.47**	.33**	.48**	.19**							
6.FF6	.540	.50**	.37**	.36**	.51**	.056						
7.FM1	.827	.47**	.46**	.44**	.26**	.44**	.18**					

8.FM2	.853	.42**	.39**	.43**	.14**	.51**	.078	.76**			
9.FM3	.753	.20**	.21**	.28**	-.039	.42**	-.019	.61**	.65**		
10.FM4	.705	.58**	.55**	.48**	.46**	.37**	.30**	.69**	.63**	.41**	
11.FM5	.658	.45**	.46**	.35**	.40**	.30**	.20**	.61**	.52**	.32**	.61**

\*\* $P < 0.01$

## 2.3 Validity analysis of EMBU

### 2.3.1 Content validity

The correlation coefficient ( $R$ ) between each item and its dimension is used to represent the convergent validity. Generally, when  $R \geq 0.4$ , it can be considered that the convergent validity is better. Discriminant validity is expressed by the correlation coefficients between the item and other dimensions (factors). It is generally believed that these correlation coefficients are lower than the correlation coefficient between the same item and its dimension (factor), the discriminant validity is better [12]. The results show that the correlation coefficient between each item and its dimension is  $> 0.4$ , which is higher than those correlation coefficients between the same item and other dimensions. the correlation coefficients between more than 81.3% of the entries and the dimension where the entry is located is  $\geq 0.4$ , and the correlation coefficients between more than 90.0% of the entries and other dimensions are less than those between the same entries and their dimensions. The calibration success rates of convergent validity are more than 81.3%, and the calibration success rates of discriminant validity are more than 90.0%. See Table 4.

Table 4 Convergent Validity and Discriminant Validity of EMBU

Dimension	item number	Convergent Validity			Discriminant Validity		
		range of $R$	success	success rate	range of $R$	success	success rate
FF1	19	.409~.676	19/19	100	.268~.422	87/95	91.6
FF2	12	.382~.553	11/12	91.7	.239~.525	55/60	91.7
FF3	10	.368~.561	9/10	90.0	.105~.519	47/50	94.0
FF4	5	.410~.687	5/5	100	.155~.492	24/25	96.0
FF5	6	.526~.613	6/6	100	.138~.542	26/30	86.7
FF6	6	.420~.589	5/5	100	.384~.527	46/50	92.0
FM1	19	.405~.688	19/19	100	.049~.659	72/76	94.7
FM2	16	.374~.733	13/16	81.3	.045~.682	58/64	90.0
FM3	8	.392~.661	7/8	87.5	.033~.510	29/32	90.6
FM4	9	.337~.628	8/9	88.9	.096~.533	34/36	94.4
FM5	5	.414~.666	5/5	100	.123~.529	20/20	100

### 2.3.2 Construct validity

First, factor analysis is carried out on Father's subscale. As KMO value of 58 items in Father's subscale is 0.865, and Bartlett's spherical test value is 13501.550 ( $df = 1653$ ),  $P < 0.001$ , the data is suitable for factor analysis. According to the eigen value greater than 1.0, six principal components are extracted and the cumulative contribution rate is 61.118%, which basically reflects the theoretical idea of the original scale. See Table 5 for the load of each factor and eigenvalue. Second, Factor analysis is carried out on Mother's subscale. As KMO value of 57 items in Mother's subscale is 0.901 and Bartlett's spherical test value is 14827.772 ( $df = 1653$ ),  $P < 0.001$ , the data is suitable for factor analysis. Five principal components are extracted according to the eigenvalue greater than 1.0, with a contributive rate of 64.007%. See Table 6 for the load of each factor and eigenvalue.

Table 5 Principal Component Analysis of 58 Items of Father's Subscale and Load of Each Factor (> 0.4)

1 <sup>st</sup> principal component		2 <sup>nd</sup> principal component		3 <sup>rd</sup> principal component		4 <sup>th</sup> principal component		5 <sup>th</sup> principal component		6 <sup>th</sup> principal component	
item	factor load	item	factor load	item	factor load	item	factor load	item	factor load	item	factor load
2	.685	5	.717	1	.741	3	.820	21	.628	12	.774
4	.569	13	.733	10	.677	8	.768	23	.567	16	.663
6	.673	17	.687	11	.515	22	.741	28	.745	39	.655
7	.692	18	.624	14	.549	64	.697	34	.609	40	.547
9	.587	43	.672	27	.651	65	.754	35	.766	46	.679
15	.695	49	.709	36	.739			45	.781	59	.740
20	.646	51	.654	48	.572						
25	.627	52	.704	50	.744						
29	.603	53	.527	56	.779						
30	.544	55	.699	57	.813						
31	.531	58	.738								
32	.660	62	.525								
33	.727										
37	.511										
42	.534										
44	.644										
60	.736										
61	.670										
66	.543										

Table 6 Principal Component Analysis of 57 Items of Mother's Subscale and Load of Each Factor (>0.4)

1 <sup>st</sup> principal component		2 <sup>nd</sup> principal component		3 <sup>rd</sup> principal component		4 <sup>th</sup> principal component		5 <sup>th</sup> principal component	
item	factor load	item	factor load	item	factor load	item	factor load	item	factor load
2	.750	1	.819	23	.767	13	.831	3	.766
4	.633	11	.674	26	.815	17	.784	8	.678
6	.577	12	.759	28	.791	43	.750	22	.593
7	.588	14	.763	34	.774	51	.735	64	.746
9	.562	16	.807	38	.806	52	.761	65	.827
15	.724	19	.717	39	.487	53	.477		
25	.675	24	.688	45	.822	55	.814		
29	.692	27	.725	47	.811	58	.644		
30	.756	35	.730			62	.799		
31	.587	36	.829						
32	.769	41	.748						
33	.838	48	.825						
37	.761	50	.511						
42	.643	56	.782						
44	.550	57	.824						
54	.577	59	.776						
60	.801								
61	.754								
63	.822								

### III. Discussion

This study finds that the psychometric performance of EMBU is good, which is consistent with the results of previous similar literature [9-11], suggesting that EMBU is suitable for junior high school students in Guangdong Province.

Firstly, the test results of internal consistency reliability, split half reliability, structural validity (convergent validity, discriminant validity and principal component analysis), and ceiling /floor effect show that EMBU has good psychometric performance. In addition to the two dimensions of father preference and mother preference, the split half reliability of the two subscales of EMBU and the other nine dimensions are more than 0.7, meeting the requirements of psychometrics, which is consistent with the results of previous studies [6-7,13-14]. The reason why the split half reliability of the two dimensions of father preference and mother preference are low may be related to the small and odd number of items. In addition to the two dimensions of father overprotection and mother preference, the internal consistency reliability of the two subscales of EMBU and the other nine dimensions are more than 0.7, meeting the requirements of psychometrics. The low internal consistency reliability of the two dimensions of father overprotection and mother preference may be due to the different

understanding of the meaning of relevant items between the East and the West. For example, in the view of Chinese people, item 46 of the original scale "whenever I eat, my parents persuade or force me to eat more" is more understood as the warmth of parents than excessive protection. The above situation suggests that the items of the three dimensions of father preference, father overprotection and mother preference need to be further enriched and improved.

This study finds that the calibration success rates of convergent validity of 11 dimensions in EMBU are more than 81.3%, and the calibration success rates of discriminant validity are more than 90.0%, which was consistent with the results of previous literature [6,7,14], suggesting that EMBU has good convergent validity and discriminant validity.

Factor analysis is carried out on two subscales. According to the eigenvalue greater than 1.0, six principal components are extracted from Father's subscale and five principal components are extracted from mother's subscale, and the cumulative contribution rate are 61.118% and 64.007%, respectively, which basically reflects the theoretical idea of the original scale. The results of factor analysis in this study are consistent with the ideas of previous studies [6, 7, 14], suggesting that EMBU has good structural validity when applied to junior high school students in Guangdong Province.

The scores of 11 dimensions in this group are normally distributed, and there is no floor effect or ceiling effect, which is consistent with the results of previous studies [6,7]. It is suggested that the item sampling of EMBU is reasonable and can represent the basic connotation of parental rearing style, and the preparation of the scale is scientific.

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