



Original Article

Vulnerable Baby Scale: A validity and reliability study

Melike Yavaş Çelik,¹ Zerrin Cığdem²

¹Department of Nursing, Kilis 7 Aralık University Yusuf Şerefoğlu Faculty of Health Sciences, Kilis, Turkey

²Department of Nursing, Hasan Kalyoncu University Faculty of Health Sciences, Gaziantep, Turkey

Abstract

Objectives: This study aims to evaluate the validity and reliability of the Vulnerable Baby Scale (VBS) in Turkish.

Methods: This methodological study was conducted between December and July, 2019 with 371 mothers having babies between the ages of 1 week and 4 months.

Results: Language validity of VBS was determined to be appropriate after translation-back translation and expert opinion. The sample adequacy calculated for the VBS was evaluated as very good Kaiser Mayer Olkin (KMO=0.851, $X^2=665.065$). The Confirmatory Factor Analysis (CFA) determined that the VBS maintained its single-factor structure of 10 items, factor loadings of the VBS items ranged between 0.38 and 1.16 and the CFA fit index values were within acceptable limits/perfect fit limits. In this study, Cronbach's alpha reliability coefficient was found to be 0.84. The two half reliability levels of the scale were evaluated as 0.85. A moderate positive correlation was found between the Edinburgh Postpartum Depression Scale (EPDS) and the VBS ($r=0.32$). Test-retest results showed a weak positive and significant relationship ($r=0.99$).

Conclusion: It was concluded that Turkish version of the VBS had sufficient internal reliability and validity to be able to evaluate the perception of "Vulnerable Baby Syndrome".

Keywords: Reliability; validity; vulnerable baby syndrome.

What is known on this subject?

- The evaluation, underlying factors and definition of vulnerable baby syndrome were first presented by Green and Solnit (1964). A number of scales have been developed to evaluate parental perception of child vulnerability in the following years. However, this issue has not been studied in Turkey as there is no tool to use for evaluation.

What is the contribution of this paper?

- This study has explained the vulnerability that closely affects children's growth and development, and adapted the Vulnerable Baby Scale into Turkish so parental perceptions of the vulnerability of their babies can be assessed.

What is its contribution to the practice?

- This scale can be administered to mother/baby groups with different characteristics in order to examine the factors affecting maternal perception of the vulnerability regarding both the mother and her baby. The scale can also be used to contribute to the development of supportive and comforting characteristics of a mother that meets the emotional needs of the baby, and supports mother-infant interaction during infant follow-up interviews with the mother.

Perceptions and expectations have an important place in social relationships and can affect both the mother's care behaviors and the baby's developmental stages.^[1-3] Most mothers have positive expectations for their babies from the moment they become pregnant, and they develop a healthy and warm relationship with their babies. However, some mothers may perceive their babies as "vulnerable" due to their concerns about the baby's health and inability to understand the baby's special needs. A lack of support systems, high-risk situations they encountered during pregnancy, childbirth or any period after childbirth contribute to these concerns. The mother's perception of her baby as vulnerable can affect both the baby's growth-development process and mother-baby attachment, causing deficiencies in maternal roles. The mother's perception/evaluation of her baby as sensitive and vulnerable can lead to vulnerable child syndrome (VCS).^[1-3]

Address for correspondence: Melike Yavaş Çelik, Kilis 7 Aralık Üniversitesi Yusuf Şerefoğlu Sağlık Bilimleri Fakültesi, Kilis, Turkey

Phone: +90 348 814 30 95 **E-mail:** www_com_tr@hotmail.com **ORCID:** 0000-0002-1155-1022

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The VCS was first identified by Green and Solnit^[2] in 1964 as a parental anxiety regarding losing their child in a short period of time, even though the child has recovered from a life-threatening health issue.^[1,2] In the literature, the risk factors defined for VCS include: preterm births, pregnancy and perinatal complications, postpartum depression, difficulties in conception by assisted reproductive technologies, feeding problems and crying behaviors during infancy, admission to intensive care or hospitalization, situations requiring prolonged separation from the baby, family concerns, maternal depression, abortion, lack of social support, having a single child, previous infant losses, high socio-economic family status, high education level, changes in parents' health status, child-rearing attitudes, and self-efficacy status.^[1-12]

Perceived vulnerability causes excess anxiety in the mother about her baby's physical condition, leading to difficulties in separation from the baby. As a result, the baby has difficulty adapting to the environment, lags in learning/developing new behaviors, is unable to socialize properly and cope with shortages/disappointments, has lack of self-confidence and academic failure, and displays aggressive behaviors in the future.^[2,4]

Psychoanalytic theorists emphasize the importance of mothers' perception of and relationship with their babies during the early years in the baby's developmental process.^[13,14] Babies have impulses seeking discharge and internal objects existing from childbirth, which are ready to turn towards their mothers. Several psychoanalytic theorists have stated that situations that negatively affect mother-infant bonding in early years also affects the infant's behaviors in later years, and therefore an extensive psychoanalysis is needed to evaluate both the baby and the parents who have such difficulties.^[13,14]

According to the object relations theory, a deprivation due to the mother's inability to perceive the baby's needs causes the baby to be unable to create a transitional object and space. A child who has experienced deprivation or lose of an object they considered reliable in early childhood cannot play "games and cannot be genuine and socialize when they becomes an adult.^[15] The theorists emphasize the importance of having a healthy childhood, and state that situations negatively affecting the healthy mother-baby bonding expected to occur in this period should be assessed.^[13-15] Therefore, health-care professionals, especially nurses and midwives who have the closest relationship with both the mother and the baby in the postpartum period, should be aware of the risks of maternal perception of baby vulnerability. Nurses and midwives can evaluate the mother's perception of baby vulnerability by using the VBS, providing her with the support she needs by making early interventions, and thus reducing her anxiety and perceived vulnerability of the baby, which helps prevent the mother from developing overprotective behaviors. As a result, development of cognitive and behavioral problems, low activity levels, difficult parent-child interactions, psychosomatic diseases, excessive/unnecessary use of health services, poor

developmental outcomes, and school failure can be prevented in the later stages of life of infants who are perceived as vulnerable.^[1-13]

Studies have reported that the mother's perception of child vulnerability negatively affects the child's psychosocial development. However, the effect of perception of baby vulnerability on psychosocial development has not been studied adequately, whereby the factors regarding both mother and baby that affect the development of mother's perception of baby vulnerability in early babyhood is not fully determined.^[1-10] In Turkey, Dogan et al.^[10] (2009) and Metin et al.^[16] (2016) have conducted studies on children aged 4-5 years to evaluate the mothers' perceptions of child vulnerability, but there is no study assessing the infancy period. Recent studies have not sufficiently examined the mothers' perception of baby vulnerability, and have not emphasized the individual contributions of both mother and baby to the mother's perception of baby vulnerability. Therefore, a valid and reliable method to evaluate in detail the mothers' perceptions of baby vulnerability in early childhood is needed. This study aims to test the validity and reliability of the Vulnerable Baby Scale (VBS) developed by Kerruish et al.^[8] (2005) in order to evaluate the VCS in Turkish society.

Materials and Method

This is a methodological study.

Study Population and Sample

The study population consisted of 750 mothers presenting to the pediatric/newborn outpatient clinics of one public and one private hospital in Gaziantep and one public hospital in Kilis in Turkey between December and July 2019 and whose babies were hospitalized in the Neonatal Intensive Care Unit (NICU). The study sample consisted of 371 Turkish mothers without health issues who presented to the above-mentioned hospitals and had a preterm baby aged between one week and four months with low birth weight and had been discharged from the hospital after they received medical treatment and care in the NICU for at least five days.

Data Collection Tools

Data were collected using a Survey Form, the Edinburgh Postpartum Depression Scale, and the Vulnerable Baby Scale.

Survey Form: This form was prepared by the researchers and included questions about the participants' socio-demographic characteristics and pregnancy and childbirth and postpartum periods, which are considered to be related to maternal perception of baby vulnerability.

Edinburgh Postpartum Depression Scale (EPDS): This scale was developed by Cox and Holden^[17] (1987), and adapted to Turkish by Engindeniz et al.^[18] (1996). This self-assessment scale is used to evaluate the risk, level and change in severity of de-

pression of women in the postpartum period. It is easy to use because it is short and understandable, thus individuals can complete it on their own. This scale is a four-point Likert type scale with 10 items. It includes an instruction manual at the beginning, whereby individuals are asked to mark the item that best suits their situation when responding to the scale. The items no.3, 5, 6, 7, 8, 9 and 10 are scored as 3, 2, 1, 0, while the items no.1, 2 and 4 contain reverse expressions and are scored as 0, 1, 2, 3. Total scale score is obtained by summing item scores. Higher scores indicate more severe depressive symptoms. The highest and lowest total scale scores are 30 and 0, respectively. In the validity-reliability study of the scale, the cut-off score was found as 12/13 and the Cronbach's alpha value was determined as 0.79.^[17,18,19]

Vulnerable Baby Scale (VBS): The scale was developed by Keruish et al.^[8] (2005) to assess maternal perceptions of baby vulnerability. This is a five-point Likert type scale with 10 items and a total scale score of 50. A score of 27 and above indicates a high maternal perception of baby vulnerability. The scale can be administered to mothers who have babies aged between 0–4 months. In order for the scale to be used, the mother and her baby should be together. The scale should not be used in case of a mother-baby separation for any reason. Keruish et al. found the Cronbach's alpha reliability coefficient of the scale as 0.70.

Data Evaluation

Data were statistically analyzed using SPSS 15.0 for Windows (Statistical Package for Social Sciences) and Lisrel 8.7 program. The translation-back translation method was used for language adaptation of the scale, and the Kendall's W test was used to assess content validity of the scale and concordance of expert opinions. Construct validity of the VBS was examined by CFA. KMO and Bartlett's tests were used to determine the sampling adequacy before conducting the factor analysis. A known group comparison method was used for criterion validity of the scale.

Test-retest method, Cronbach's alpha coefficient, equivalent form reliability, and split-half method were used for reliability study of the scale. Total scores of VBS and EPDS items were calculated in the test-retest method for the equivalent form reliability, whereby the correlations were checked. Pearson product-moment correlation coefficient (Pearson's correlation) was calculated to examine the relationship between item scores. Also, dependent samples t-test was used to examine the difference between total mean scores of VBS items in the test-retest group.

Ethical Considerations

The necessary permission to use the VBS was obtained via e-mail from Keruish, who developed the VBS. In addition, an ethical approval dated 06.11.2018 and numbered 2018-08 was obtained from Hasan Kalyoncu University Faculty of Health

Sciences Non-Invasive Research Ethics Committee, and institutional permissions from Gaziantep Public Hospitals Association on 03.12.2018, Gaziantep ANKA Hospital on 28.11.2018, and Kilis Public Hospitals Association on 19.11.2018. Before data collection, the purpose of the study was explained to the mothers and their verbal and written consents were obtained.

Results

1. Validity Study of the VBS

Language Adaptation and Content Validity

The translation-back translation method was used to test language validity of the VBS. Opinions of 13 experts were received to evaluate content validity of the scale. Accordingly, they scored the scale items between 2 and 4 out of 4, where the mean score was between 3.6 and 4. The Kendall's W test statistics showed a good level of agreement among the experts ($p > 0.05$) (Table 1).

For construct validity of the scale, the sample size was first tested by KMO and Bartlett's Test, where the sample size was evaluated as very good according to the results (KMO=0.851, $X^2=665.065$, $p=0.00$) (Table 1).

Construct Validity

The CFA revealed that the VBS preserved its 10-item single-factor structure, where the item factor loads varied between 0.38 and 1.16. Accordingly, all CFA fit indices were within acceptable/perfect fit limits (NFI=0.94, NNFI=0.96, IFI=0.97, RFI=0.92, CFI=0.97, GFI=0.93, AGFI=0.88, RMR=0.07, REMSEA=0.076, $X^2/SD=2.06$) (Table 1).

Criterion Validity

Finally, the known group comparison analysis performed for criterion validity of the scale demonstrated that the mothers with preterm babies (65.99) obtained higher VBS mean score than those with term babies (46.03), and those who conceived their babies with assisted reproduction techniques (46.86) had higher VBS mean score than those who conceived their babies naturally (32.14) ($p < 0.01$) (Table 1).

2. Reliability Study of the VBS

Internal Consistency Results

The Cronbach's alpha reliability coefficient was found as 0.84 in the analysis for internal consistency of the single-factor VBS. The item-total score correlations of the VBS varied between 0.35 and 0.73, and the Cronbach's alpha coefficient did not change significantly when any item was removed from the scale (Table 1).

The Spearman-Brown correlation and the Guttman Split-Half value were found as $r=0.852$ and $r=0.851$, respectively, in the

Table 1. Validity and reliability analyses of the Vulnerable Baby Scale

Tests	Results
Validity	
Language adaptation	The translation-back translation technique was used for the language validity. Three experts living in England translated the scale from English to Turkish. Then, two health experts translated the scale from Turkish to English.
Content validity	Kendall's W test showed that the experts were in consensus ($p>0.05$).
Construct validity (n=184)	KMO=0.851, $X^2=665.065$, $p=0.000$ In the CFA, the 10-item single-factor structure of the scale was preserved, the factor loadings of the items varied between 0.38 and 1.16. The CFA fit indices were as follows: NFI=0.94, NNFI=0.96, IFI= 0.97, RFI=0.92, CFI=0.97, GFI=0.93, AGFI=0.88, RMR0.07, REMSEA=0.076, $X^2/SD= 2.06$.
Criterion validity	(Known group comparison) (n=58, n=109) Mothers with preterm babies (65.99) had a higher VBS mean score than those with term babies (46.03). Mothers who conceived their babies with assisted reproduction techniques (46.86) had higher VBS mean score than those who conceived their babies naturally (32.14) ($p<0.01$).
Reliability	
Internal Consistency	Cronbach's alpha reliability coefficient = 0.849
Split-half reliability (n=104)	Spearman-Brown correlation coefficient $r=0.852$,
Equivalent form reliability (n=184)	Guttman Split-half value $r=0.851$. Equivalent form reliability $r=0.32$
Time invariance test re-test (n=109)	A moderate positive correlation was found between the two measurement tools. A statistically significant strong positive relationship was found between the results of the test re-test analysis of the time invariance of the scale ($r=0.99$) ($p>0.05$).

analysis performed by the split-half method. The split-half reliability of the scale was determined as 0.85 (Table 1). The EPDS was used for equivalent form reliability of the scale. The Pearson's correlation was found as $r=0.32$, suggesting a weak positive correlation between the two measurement tools (Table 1).

Time Invariance Results

Finally, the analysis for time invariance of the scale revealed a statistically significant strong positive relationship between the VBS scores when the scale was administered twice in 15 days intervals ($r=0.99$). In addition, the mean scores obtained from the first and second administrations were compared using the dependent samples t-test, and no statistically significant difference was found between them ($p>0.05$).

Confirmatory Factor Analysis

As seen in Figure 1, a modification was recommended for items 7–8 and 3–9. After the modification, the single factor structure of the scale was preserved, where the factor loadings varied between 0.38 and 1.16.

Discussion

The first method used for a scale adaptation is language adaptation. In scale adaptation studies, the translation should be understandable to minimize the diversity between two cultures.^[20] The translation-back translation method is preferred widely in language adaptation.^[20,21] The translation-back translation method was used for language adaptation of the

VBS, whose original language is English. First, the scale was translated from English to Turkish independently by three experts who had an advanced level of English and have lived in England for a long period of time. Then, the researchers exam-

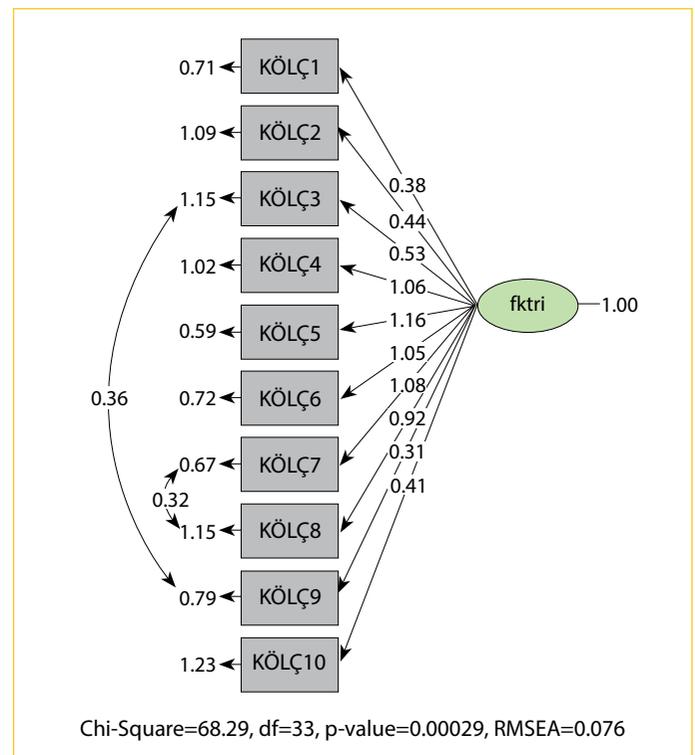


Fig 1. PATH Diagram of the Turkish version of the Vulnerable Baby Scale.

ined all translations of the scale by comparing them with the original text, and the expressions that best reflected the scale items were selected and arranged. Afterwards, the back translation was made independently by two health experts who understood both Turkish and English languages very well, and no significant difference was found between the meanings of the two translations.

Validity Study of the VBS

The first thing to look for a scale is validity. Even when a scale is reliable, it may not be valid. For example, a scale may include question(s) regarding issues other than the subject to be evaluated by the scale. The methods used for scale validity are content, construct and criterion validity.^[22]

Content Validity

Content validity is used to determine the extent to which the scale as a whole and each item in the scale explain the subject to be evaluated.^[24] In this study, the opinions of 13 experts were obtained for the content validity assessment of the scale. Accordingly, they scored the scale items between 2 and 4 out of 4, where the mean score was between 3.6 and 4. The expert opinions were evaluated by using the Kendall's W test. As a result, their opinions conformed with each other, where there was no statistically significant difference between their opinions. Studies have reported that the Kendall's W test is a reliable method used to assess expert responses.^[23]

Construct Validity

Before factor analysis, KMO is recommended to use in determining the adequacy of sample size and the Barlett's test in examining the suitability of sample for factor analysis. The KMO value varies between 0 and 1, where the value is expected to be above 0.60.^[22] In this study, the KMO coefficient was found as 0.851, and the chi-square value of the Barlett's test was significant at a significance level of $p < 0.05$, suggesting a sufficient suitability of the sample for factor analysis.

Confirmatory Factor Analysis (CFA) investigates construct validity and is performed to determine whether the available data conforms to the original structure. Thus, the researcher tests whether the available data is compatible with the previously constructed factor structure. CFA is a validity determination method especially used in adaptation of assessment tools developed in other cultures and samplings. In other words, CFA is an analysis aimed at evaluating to what extent the factors formed using many variables with the support of an institutional basis match the actual data.^[24,25] In this study, CFA was performed for construct validity of the scale. As seen in Figure 1, a modification was recommended for the VBS items 7–8 and 3–9. After the modification, the single factor structure of the scale was found to be preserved, where the factor loadings varied between 0.38 and 1.16. The CFA fit index values were within acceptable/perfect fit limits.

Criterion Validity

Known group comparison method is one method used for criterion validity. In this comparison method, a scale is administered to two different groups, which are considered dissimilar to each other in terms of the desired feature to be measured, and then the results are compared. The difference between the two groups can be determined by applying variance analysis or t-test.^[24,25] In this study, the VBS mean scores of the mothers who conceived a baby with assisted reproduction technology and those who conceived a baby naturally were compared, and a statistically significant difference was found between them ($p < 0.05$). In addition, the VBS mean scores of the mothers with preterm and term babies were compared, and there was a statistically significant difference between them ($p < 0.05$).

According to these results, the mothers who conceived a baby with assisted reproduction technology had higher VBS mean score than those who got pregnant naturally. The mothers with preterm babies had higher VBS mean score than those with term babies. With these analyses, the accuracy of the fact that preterm delivery and having a baby with assisted reproductive technology have an effect on the formation of maternal perception of baby vulnerability was tested, and the results obtained were consistent with those in the literature.^[2–12]

Reliability Study of the VBS

Two types of reliability criteria, internal consistency and time invariance, should be tested on a measurement tool.^[22–26] In this study, internal consistency (Cronbach's alpha reliability coefficient, equivalent forms reliability, split-half method) and time-invariance (test re-test) method were used to determine the reliability of VBS.

Internal Consistency Results

Cronbach's alpha coefficient is frequently used in Likert-type scales. The consistency between scale items is determined by calculating the Cronbach's alpha coefficient.^[22] The Cronbach's alpha coefficient should be 0.60 and above, where a value varies between 0.00–0.40 refers to unreliability, 0.40–0.60 to a low reliability, 0.60–0.80 to reliability, and 0.80–1.00 to a high reliability.^[27] In this study, the Cronbach's alpha reliability coefficient was found to be 0.849 for internal consistency of the single factor VBS, suggesting a high scale reliability. The item-total score correlations of 10 items were examined for the reliability of VBS, and the correlations varied between 0.35 and 0.73. In addition, when any item was removed from the scale, the Cronbach's alpha coefficient did not change significantly. The Cronbach's alpha coefficient of the VBS was found as 0.70 by Kerruish et al. (2005).^[8]

The split-half method is obtained by dividing the available data into two equal parts and examining the consistency between these two equal parts. This method has been developed to eliminate both the time invariance problem arising in

the test re-test method and the difficulty finding equivalent forms in the equivalent form reliability. This is calculated using the Spearman-Brown Prophecy formula to find the reliability coefficient for the entire scale. If the Spearman-Brown value is greater than 0.70, the internal consistency reliability is considered high.^[22] In this study, the analysis using the split-half method showed the Spearman-Brown correlation value was $r=0.852$, the Guttman Split-Half value was $r=0.851$, and the split-half reliability of the scale was 0.85.

Equivalent form reliability tests the correlation between an instrument and a second measurement tool, which is known to measure a subject with the same or similar content as the instrument does, by using the second measurement tool on the same group. The correlation value obtained indicates the level of stability in measurement results.^[22] In this study, the Edinburgh Postnatal Depression Scale (EPDS) was used for the equivalent form reliability of the VBS, and the Pearson's correlation was found as $r=0.32$. A weak positive correlation was found between the two measurement tools. Kerruish et al.^[8] (2005) also found a weak positive correlation between VBS and EPDS ($r=0.3$).

Time Invariance (Test Re-Test) Results

Time invariance, another method used for reliability, is a time sampling model. In the test re-test method, the measurement tool is administered to a certain group continuously or after a certain time (desired time interval is 15 to 30 days). Thus, the test-re-test reliability of the scale is determined by testing the correlation between the two administrations. The recommendation is to study at least 30 people for test-re-test analysis.^[22,28] In this study, the test re-test results of 109 mothers were examined, and a statistically significant positive strong relationship was found between the two administrations ($r=0.99$). To test the time invariance of the scale, the dependent samples t-test was used to compare the mean scores obtained from the first and second administrations, which were performed in 15 days intervals; and no statistically significant difference was found between the two mean scores ($p>0.00$). In addition, the Cronbach's alpha coefficient in the test re-test group was found to be 0.89. These results suggested that the mothers' responses to VBS did not change over time.

Conclusion

A happy and sustainable mother-baby bonding is necessary for a baby to develop a healthy ego and superego and to become an entrepreneurial, social and self-confident adult without any problems in interpersonal relations.^[14,29,30] VCS, which develops as a result of the mother's perception of her baby as vulnerable, is a factor that negatively affects this bond. Due to this syndrome, parental anxiety may increase, causing problems in mother-infant interactions and negative and long-term consequences in children such as difficulty separating from the mother, sleep disturbances, destructive behaviors, academic

failure, physically abusive behaviors towards the mother and hyperactivity. Therefore, it is necessary to evaluate VCS, which negatively affects mother-baby bonding in early childhood, and to take relevant measures to prevent this syndrome.^[1-8] However, there is no Turkish measurement tool to evaluate the parental perceptions of baby vulnerability in mothers with babies aged between 4 weeks and 4 months. In this regard, this study, which was conducted to use the VBS, developed by Kerruish et al., as a measurement tool to determine the level of VCS in Turkey, has concluded that the VBS can be used as a valid and reliable instrument in Turkish society.

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