A Validity and Reliability Study Investigating the Turkish Version of the Infant Colic Scale

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The Infant Colic Scale is used to diagnose colic and to determine factors that cause colic. This study aimed to establish the validity and reliability of the Infant Colic Scale for the Turkish population. The research sample included mothers ($N = 110$) of 132 infants with colic registered at three public health clinics in the Denizli province.

Language validity, content validity, and construct validity were examined. On the basis of the Infant Colic Scale's internal consistency reliability analysis, three items were removed. Factor analysis resulted in five subscales. The Cronbach's alpha coefficients were .55 to .89 for the subscales, and .73 for the total scale. The scale's test–retest reliability was .65. The Infant Colic Scale was found to be a valid and reliable measurement tool for the Turkish population.

Infantile colic is a syndrome seen in developed healthy infants 2 weeks to 4 months of age. The syndrome is characterized by excessive crying that is difficult to stop despite all efforts. The colicky infant draws the legs to the abdomen, forms the hands into fists, and passes flatus. Symptoms are more frequently seen in the evening, and the etiology is not fully understood (Roy, Silverman, & Alagille, 1995).

Background

In a classic study by Wessel, Cobb, Jackson, Harris, and Detwiller (1954), colic was defined as paroxysms of crying that (a) begin in the first weeks of life and generally are seen in the first 3 months, (b) occur more than 3 hr a day for more than 3 days a week and continue for at least 3 weeks, (c) generally occur in the afternoon and evening, and (d) cannot be explained or controlled. Colic paroxysms generally occur in the 2nd week and reach their peak in the 6th week of life (Barr, Chen, Hopkins, & Westra, 1996; Keefe, Karlsen, Lobo, Kotzer, & Dudley, 2006).

Infant colic leads to unnecessary hospitalization of infants, conflicts in the parent–infant relationship, problems in the marriage, and harm to the infant (Alexandrovich, Rakovitskaya, Kolmo, Sidorova, & Shushunov, 2003). Canivet, Jakobsson, and Hagander (2000) evaluated colicky infants who had reached 4 years of age and found that these children have more negative personalities, experience difficulties with eating, and exhibit more abdominal pain. Relieving or lessening the symptoms of infantile colic is important because the disorder can harm the relationship between the infant and his or her family (Yalaz, 2003).

Infantile colic affects 30% of the infant population. For this reason, nurses who work in pediatrics are likely to see colic in their practice (Neu & Robinson, 2003). The goals of nursing interventions for infantile colic are to improve the family's effective coping methods and to increase the self-confidence of the parents in the care of their infant. Some of the nursing interventions used to accomplish these goals involve informing the parents about the characteristics of colic, helping the parents set aside time for themselves, and identifying methods that decrease or alleviate colic (Pillitteri, 1999).

Received September 28, 2006; accepted January 10, 2007.

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The major problem that causes infantile colic still is not known. The causes are multifactorial (Ellett et al., 2003). Some possible factors that could cause infantile colic are gastrointestinal system problems, disturbances in the parent–infant relationship, and central nervous system immaturity (Ellett, 2003; Lindberg, 2000; Roberts, Ostapchuk, & O'Brien, 2004).

The criteria that define colic are unclear, and there is no consensus of opinion. The diagnosis of colic and the determination of factors that cause colic are important, however, in selecting interventions that can relieve the infant's symptoms. This study was planned to determine whether the Infant Colic Scale can help nurses diagnose colic and whether it is valid and reliable for use in the Turkish population.

Methods

Sample and Setting

This study was conducted in the Denizli province of western Turkey. To establish the study sample, 21 neighborhood public health clinics affiliated with the Denizli Province Health Ministry were divided into three groups of low, middle, and high socioeconomic status. To facilitate more generalizability of findings, one clinic was chosen from each socioeconomic level using a simple random sampling method (Burns & Grove, 2001). Public Health Clinic 1 was chosen to represent the low socioeconomic level, Public Health Clinic 4 the middle socioeconomic level, and Public Health Clinic 20 the high socioeconomic level.

The research sample was composed of 132 infants and their mothers (from an original identified population of 168) who met the study criteria and were registered in Public Health Clinic 1, 4, or 20. The study criteria required that the infants be 2 to 6 weeks old, given to unexplainable crying at least 3 days a week for more than 3 hr a day, born at term, and healthy.

The number of items in the scale (n = 22) was taken into consideration in determining the appropriate sample size for the study (Bryman, & Cramer, 2001). The goal for the research sample was determined to be 110 colicky infants and their mothers, which is five times the 22 items on the Infant Colic Scale. Data were collected by the researchers using a face-to-face interview technique. The duration of the interview was approximately 15 min for each participant.

Instruments

The research data were collected with three tools: (a) a demographic data form about the participants, (b) a demographic data form about the infants, and (c) the Infant Colic Scale. The demographic data form about the participants contained four questions eliciting the mother's age, education, income status, and occupation. The demographic data form about the infants contained two questions eliciting the infant's gender and feeding status. The Infant Colic Scale was developed by Ellett et al. (2003) to help healthcare professionals diagnose colic in infants. The tool has a total of 22 items in five subscales: (a) Cow's Milk/Soy Protein Allergy/Intolerance (2 items), (b) Immature Gastrointestinal System (4 items), (c) Immature Central Nervous System (8 items), (d) Difficult Infant Temperament (4 items), and (e) Parent–Infant Interaction + Problem Infant (4 items).

The Infant Colic Scale items are evaluated on a 6-point Likert-type scale. The responses range from 1 (*strongly disagree*) and 6 (*strongly agree*). A low total score from the tool is positive for showing colic, and a high score indicates a negative state (Ellett et al., 2003).

Study Validity

Language Validity

Before the study was started, permission was obtained from the author who developed the tool (Ellett) to use it in Turkey. For tool validity to be established, the language validity of the Turkish version of the Infant Colic Scale had to be assessed.

First, the Infant Colic Scale was translated from English to Turkish by two nursing instructors and an English language expert. The researchers combined the three translations into one Turkish text. Next, the Turkish version of the Infant Colic Scale was translated back from Turkish into English by two language experts whose English was credible and by an American nurse living in Turkey, none of whom had seen the original English text of the tool. The English statements of the Infant Colic Scale that had been retranslated from Turkish to English were compared with the original English statements, and necessary revisions were made to ensure accurate translation.

Content Validity

The Turkish version of the Infant Colic Scale was sent to a total of nine teaching faculty (seven in pediatric nursing, one in pediatric medicine, and one in public health nursing) for their opinions about the validity of the scale. These experts evaluated every item for its distinctiveness, understandability, and appropriateness for the tool's purpose. Necessary changes were made in the statements based on the recommendations of the experts, and the tool was given its final form.

To address the feedback of the content experts, the term *baby* in the Immature Gastrointestinal System, Immature Central Nervous System, Difficult Infant Temperament, and Parent–Infant Interaction + Problem Infant subscales was changed to *my baby*. The statement "Baby may still be vomiting when time for the next feeding" in the Immature Gastrointestinal System subscales was changed to "My baby also vomits between feedings," and "Baby vomits milk that looks like it did before it was drunk" was changed to "My baby vomits undigested milk."

Construct Validity

Factor analysis was conducted to test the construct validity of the Infant Colic Scale. Before the factor analysis of the Infant Colic Scale was conducted, measures of sampling adequacy (the Kaiser Mayer Orkin [KMO] statistic and Bartelett's test) were calculated to evaluate whether the sample was large enough for performance of a satisfactory factor analysis. The KMO measures sampling adequacy, which should be greater than .50 for a satisfactory analysis to proceed, and the Bartelett's test is used to establish the sphericity of the data.

Scale's Internal Consistency Reliability and Cronbach's Alpha Reliability Coefficient

The item-to-total correlation was calculated for the 22 items in the Infant Colic Scale. There was consistency for all items related to the total scale. The Cronbach's alpha coefficient also was examined to evaluate the homogeneity of the scale's items.

Test–Retest Reliability

To test the stability of the Infant Colic Scale over time, the test–retest reliability measurement was conducted. The scale was administered, and data were collected again 2 weeks later from a total of 30 colicky infants' mothers. The Pearson product–moment correlation coefficient was used to examine the correlation between the data collected the first and second times.

Data Analysis

The SPSS 10.0 statistical program was used for evaluation of the data. Before the study was started, permission was obtained from the ethics committee of Ege University School of Nursing and from the Denizli Province Health Ministry. The mothers of colicky infants who participated in the research were informed about the research study and its purpose and told they could withdraw from the study if ever they wanted to do so.

TABLE 1

Sample Demographics

Variable	*n*	%
Mothers		
Income status		
Low income	25	22.7
Balanced income	75	68.2
High income	10	9.1
Infants		
Gender		
Female	52	47.3
Male	58	52.7
Feeding status		
Breast-feeding	92	83.6
Breast- and formula-feeding	18	16.4

Note. The mean age of the mothers in the study was 27.20 (*SD* = 4.73 years), and their mean years of education was 9.93 (*SD* = 4.01 years).

Findings

Distribution of Participants' and Infants' Demographics

The mothers of 110 colicky infants participated in the study. The mean age of the mothers was 27.20 (*SD* = 4.73 years), and their mean years of education was 9.39 (*SD* = 4.01 years). The majority (79%) of the mothers were homemakers. The income for 75% of the families was equal to their expenses. More than half (52.7%) of the colicky infants were male, and 83.6% were breast-fed (Table 1).

Reliability Analysis

The item-to-total correlation was calculated to evaluate the internal consistency reliability of the Infant Colic Scale (Table 2). In the evaluation, correlation coefficients for a total of 7 items (Cow's Milk/Soy Protein Allergy/Intolerance Items 1 and 2, Immature Gastrointestinal System Items 5 and 6, and Immature Central Nervous System Items 10, 11, and 12) were found to be lower than .20 (respectively, $r = .16$; $r = .12$; $r = .06$; $r = .17$; $r = .15$; $r = .01$; $r = .13$). Items with a correlation coefficient lower than .20 generally are recommended to be removed from the tool, but this is not a hard rule. To remove an item from the scale, it also was necessary to evaluate the "change in alpha" if the item was deleted. If the alpha coefficient increased when some items were removed from a tool, then that item decreased the reliability of the tool and needed to be removed. Conversely, if the alpha value fell below the general alpha value when an item was removed, then that item was necessary for the tool (Özdamar, 1997).

For the Turkish version of the Infant Colic Scale, when Items 5 and 11 were removed, the alpha value went above the general value, so the decision was made to remove these items. The Cronbach's alpha reliability of the subscales for these items then was retested. When Item 5 was removed from the Immature Gastrointestinal System subscale, Item 6 of the subscale went over the general Cronbach's alpha value, so the decision was made to also remove the Item 6 from the scale. As a result, the subscale's Cronbach's alpha coefficient increased from .30 to .56. When Item 11 of the Immature Central Nervous System subscale was removed, the Cronbach's alpha coefficient increased from .48 to .55 (Table 3). The Cronbach's alpha coefficient for the total scale also increased from .70 to .73. The remaining items that had correlation coefficients lower than .20 (Items 1, 10, and 13), were determined to be necessary questions for the scale and were not removed (Özdamar, 1997). The tool's internal consistency reliability coefficients (see Table 2 for original values) and Cronbach's alpha values after the three items were removed are shown in Table 3.

Stability

The stability of the tool over time was evaluated with the test–retest reliability measurement. The Infant Colic Scale's test–retest correlation coefficients for the subscales were between .52 and .75. The test–retest correlation coefficient for the total scale was found to be .65 (see Table 4).

Validity Analysis

Construct Validity

The calculated KMO was .65, indicating that the sample was large enough for a satisfactory factor analysis. Factor analysis was used to evaluate 19 items. Basic components analysis

TABLE 2

Item Analysis and Internal Consistency of the Turkish Version of the Infant Colic Scale (N = 110; α = .70)

Item	*M*	*SD*	Item–total correlation	If-item-deleted α
Cow's Milk/Soy Protein Allergy/Intolerance Subscale				
1. What Mom eats affects whether the baby has colic or not.	3.13	2.13	**.16**	.70
2. What Mom eats affects how bad the colic is.	2.80	2.03	**.12**	.70
Immature Gastrointestinal System Subscale				
3. My baby does not usually vomit.	3.27	1.62	.25	.69
4. My baby also vomits between feedings.	2.71	1.89	.26	.69
5. My baby vomits undigested milk.	3.23	2.12	**.06**	.71
6. My baby has no difficulty passing stool.	2.87	2.08	**.17**	.70
Immature Central Nervous System Subscale				
7. My baby is jittery.	3.67	1.74	.35	.68
8. Colic occurs when my baby has had a busy day.	2.98	2.15	.45	.67
9. My baby does not need to be rocked to sleep.	3.90	2.04	.27	.69
10. Colic is not related to my baby being tired.	2.27	1.80	**.15**	.70
11. My baby eats at the same time every day.	4.20	2.09	**.01**	.72
12. My baby can go to sleep by him- or herself.	3.52	1.99	.36	.68
13. My baby is always in motion when awake.	5.64	0.67	**.13**	.70
14. My baby sleeps at different times every day.	4.54	1.93	.21	.70
Difficult Infant Temperament Subscale				
15. My baby is cranky most of the time.	2.96	1.75	.43	.68
16. My baby does not cry easily.	3.79	1.84	.36	.68
17. My baby is happy most of the time.	2.20	1.07	.33	.69
18. My baby waits calmly while I get the food ready.	4.98	1.63	.25	.69
Parent–Infant Interaction Subscale				
19. When my baby starts to fuss, nothing I do helps.	3.22	1.80	.45	.68
Problem Infant Subscale				
20. When the colic starts, I can soothe him or her.	2.73	1.63	.40	.68
21. When the colic starts, nothing I do helps.	3.01	1.80	.35	.68
22. I can tell what my baby wants when he or she starts to cry.	2.01	1.36	.35	.69

Note. Boldface type indicates correlation coefficients that fell below .20; items with a correlation coefficient lower than .20 generally are recommended to be removed from the tool.

was performed according to the results of a varimax rotation analysis. As Table 5 shows, the Turkish version of the tool has five factors: (a) Cow's Milk/Soy Protein Allergy/Intolerance, (b) Immature Gastrointestinal System, (c) Immature Central Nervous System, (d) Difficult Infant Temperament, and (e) Parent–Infant Interaction + Problem Infant.

All the items in the Parent–Infant Interaction + Problem Infant subscale make up Factor 1, with a 13.51% variance. All the items in the Difficult Infant Temperament subscale and two items in the Immature Central Nervous System subscale make up Factor 2, with a 12.67% variance. All the items in the Cow's Milk/Soy Protein Allergy/Intolerance subscale make up Factor 3, with an 11.52% variance. Five items in the Immature Central Nervous System make up Factor 4, with a 10.96% variance. All the items in the Immature Gastrointestinal System make up Factor 5, with an 8.95% variance. The tool explains 57.63% of the total variance.

The size of the variance percentages obtained as a result of factor analysis is the strength of the factor structure. When the factor pattern is developed, factor values between .30 and .40 can be taken as the factor load's bottom cutoff point (Neale & Liebert, 1980). The factor loads for the items on the Turkish version of the Infant Colic Scale varied between .36 and .91.

The items "My baby is jittery" and "My baby sleeps at different times every day" of the Immature Central Nervous

TABLE 3

Item–Total Subscale Correlation and Cronbach's Alpha Scores (N = 110)

Subscale	No. of items	Item–total subscale correlation	Cronbach's α
Cow's Milk/Soy Protein Allergy/Intolerance	2	.81	.89
Immature Gastrointestinal System	2	.39	.56
Immature Central Nervous System	7	.22–.46	.55
Difficult Infant Temperament	4	.38–.50	.65
Parent–Infant Interaction + Problem Infant	4	.48–.71	.78
Total scale	19		.73

System subscale were located under the Difficult Infant Temperament subscale that makes up the second factor. These items' correlation with their own subscale were reexamined, and significant correlations were found for "My baby is jittery" (r = .47) and "My baby sleeps at different times every day" (r = .33). In this way, these two items were incorporated into the Immature Central Nervous System subscale.

When the Cronbach's alpha values for the Turkish version were compared with those of the original Infant Colic Scale, the values were very close for the Cow's Milk/Soy Protein Allergy/Intolerance subscale. The Cronbach's alpha values from this study for the Immature Gastrointestinal System and Parent–Infant Interaction + Problem Infant subscales were higher than the original values, and those for the Difficult Infant Temperament and Immature Central Nervous System subscales were lower than the original values (Table 6).

TABLE 4

Distribution of Correlations Between the Turkish Version of the Infant Colic Scale Subscales' Test–Retest Scores

Subscales	Test–retest reliability correlation coefficient
Cow's Milk/Soy Protein Allergy/ Intolerance	.56
Immature Gastrointestinal System	.75
Immature Central Nervous System	.75
Difficult Infant Temperament	.52
Parent-Infant Interaction + Problem Infant	.69
Total scale (p < .01)	.65

Discussion

According to the factor analysis, the Turkish version of the Infant Colic Scale contains five factors. All the scale's subscales can be explained by a 57.63% total variance. The explained variance for single-dimensional tools needs to be at least 30%, and for multidimensional tools, it needs to be higher (Büyüköztürk, 2002). In this respect it can be said that the explained variance is sufficient for the tool, which is evaluated to be multidimensional.

The analysis result of the Turkish scale showed two items located under subscales different from the original version of the tool. In the original tool, the Immature Central Nervous System subscale Items ICNS7 ("My baby is jittery") and ICNS14 ("My baby sleeps at different times every day") were located in Factor 2. However, these items were shown to have significant correlation with their own subscale and thus were taken back under their own subscale. The differences in the cultural characteristics of Turkey may have had an effect on the comparison with the original tool.

In the evaluation of the Infant Colic Scale's internal consistency reliability, the item-to-total correlations were examined. In the evaluation, correlation coefficients for a total of seven items were found to be lower than .20. When deletions were made, as previously described, the Cronbach's alpha coefficient for the total scale increased from .70 to .73.

The stability of the tool over time was supported by correlation coefficients for the five subscales ranging from .52 to .75. The correlation between the first data collection and the collection 15 days later was examined, and the correlation coefficients varied between .56 and .75. The test–retest correlation coefficient for the total scale was found to be .65, suggesting that the scale was correctly understood by the mothers of colicky infants.

The Cronbach's alpha coefficient values for all the scale's subscales varied between .55 and .89. The Cronbach's alpha coefficient for the total scale was found to be .73. In the research of Ellett et al. (2003), the Cronbach's alpha values for the subscales were similar to the findings of the current study: Cow's Milk/Soy Protein Allergy/Intolerance (.91),

TABLE 5

Rotated Factor Analysis of the Turkish Version of the Infant Colic Scale (N = 110, 19 items)

Factor 1		Factor 2		Factor 3		Factor 4		Factor 5	
Parent–Infant Interaction + Problem Infant (PII)		Difficult Infant Temperament (DIT)		Cow's Milk/Soy Protein Allergy/ Intolerance (MSA)		Immature Central Nervous System (ICNS)		Immature Gastrointestinal System (IGS)	
PII21	.87	DIT15	.74	MSA1	.91	ICNS8	.68	IGS3	.69
PII20	.84	DIT18	.70	MSA2	.89	ICNS10	.68	IGS4	.66
PII22	.66	DIT16	.63			ICNS9	.61		
PII19	.65	ICNS7	.55			ICNS12	.58		
		DIT17	.45			ICNS13	.36		
		ICNS14	.33						
Eigenvalue = 3.75		Eigenvalue = 2.30		Eigenvalue = 1.78		Eigenvalue = 1.63		Eigenvalue = 1.48	
Variance explained = 13.51%		Variance explained = 12.67%		Variance explained = 11.52%		Variance explained = 10.96%		Variance explained = 8.95%	

Immature Gastrointestinal System (.45), Immature Central Nervous System (.61), Difficult Infant Temperament (.81), and Parent-Infant Interaction + Problem Infant (.65).

Compared with the original Infant Colic Scale's Cronbach's alpha values, the values in the current study were very close for the Cow's Milk/Soy Protein Allergy/Intolerance subscale. The Cronbach's alpha values from this study for the Immature Gastrointestinal System and Parent–Infant Interaction + Problem Infant subscales were higher than the original values, and those for the Difficult Infant Temperament and Immature Central Nervous System subscales were lower than the original values. The original scale's total Cronbach's alpha value was determined to be .73. These results show that the Infant Colic Scale can be used in Turkey for the same purpose as intended for the original. The scale was observed to be effective in the evaluations performed on the scale.

TABLE 6

Cronbach's Alpha Coefficient Subscale Scores Comparing the Turkish Sample and the Original American Sample

Subscale	Turkish sample Cronbach's α	Original sample Cronbach's α
Cow's Milk/Soy Protein Allergy/Intolerance	.89	.91
Immature Gastrointestinal System	.56	.45
Immature Central Nervous System	.55	.61
Difficult Infant Temperament	.65	.81
Parent-Infant Interaction + Problem Infant	.78	.65
Total scale	.73	.73

Conclusions

The 19-item and five-subscale Infant Colic Scale was found to be valid and reliable in Turkey. Evaluation of colic is necessary before methods to alleviate colic are used for infants. This scale is a useful and comprehensive tool for the evaluation of colic by nurses and other healthcare professionals. It is recommended that the Infant Colic Scale be evaluated in different regions of Turkey with larger samples for further determination of the tool's reliability and validity in that country.

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Commentary

Marsha Ellett, DNS, RN

Near the end of September 2004, I was delighted to receive an e-mail from Bengü Çetinkaya, an instructor at Pamukkale University Nursing School in Denizli, Turkey, requesting my permission to use the Infant Colic Scale I had developed in her dissertation research. I replied to her e-mail granting permission and attached the Infant Colic Scale, the demographic data form, and the Excel software program my son developed for scoring the scale. About a year later, I received a second e-mail requesting that I indicate which of the scale items should be reverse coded. I responded with the information requested.

In October 2006, I was very pleased to receive for review the manuscript titled "A Validity and Reliability Study Investigating the Turkish Version of the Infant Colic Scale." Of course, I had to read through it immediately to see if the manuscript was referring to the Infant Colic Scale I had developed and to see if the scale worked for nurses in Turkey. It was in fact my tool that was being tested, and the scale was found to be valid and reliable with Turkish mothers. I was ecstatic! When I calmed down and was able to read the manuscript more carefully, I realized that this was a well-designed, carefully conducted study of which the researchers should be proud.

Infant colic is an international problem recognized mostly in developing countries. Nurses worldwide need to work together to solve this as well as other common patient-care problems. Do not be afraid to contact a researcher to request an article that is unavailable to you or to ask to use an instrument the researcher developed. The researcher will be delighted to receive the request, and most will give you permission to use their instrument and even facilitate you receiving a copy.

Also, it is very important that psychometric testing be done on any instrument whenever it is introduced into a new culture. Researchers cannot assume that because an instrument has been found to be valid and reliable in one or more cultures, it is also going to be valid and reliable in the new culture. This study has made an important contribution to nursing research by extending the validity and reliability of the Infant Colic Scale.