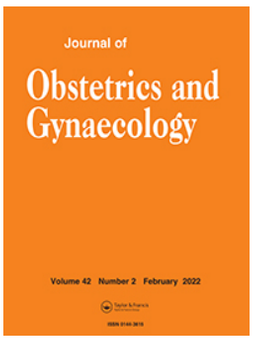

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RESEARCH ARTICLE

Psychometric properties of the Pregnancy-Unique Quantification of Emesis (PUQE-24) Scale

Tulay Yilmaz[a], Hüsniye Dinç Kaya[a], Sevil Günaydin[a], Neriman Güdücü[a] and Melike Dişsiz[b]

[a]Faculty of Health Sciences, Department of Midwifery, Istanbul University-Cerrahpaşa, Istanbul, Turkey; [b]Faculty of Nursing, Department of Obstetrics and Gyneacology, University of Health Sciences, Istanbul, Turkey

ABSTRACT

The objective of this study is to conduct a reliability and validity study of the Turkish version of the 'Pregnancy-Unique Quantification of Emesis (PUQE-24)' in pregnant women. In the Turkish version, Cronbach's alpha coefficient was 0.75, and the item-total score correlations were between 0.75 and 0.85. In the exploratory factor analysis it was determined that the scale had a single-factor structure explaining 65.968% of the total variance. The factor load values of the scale were found to be between 0.776 and 0.831. The Turkish version of scale was found to be a valid and reliable measurement in pregnant women.

IMPACT STATEMENT

- **What is already known on this subject?** Complaints of nausea and vomiting during pregnancy are common. Therefore, it is important to evaluate nausea and vomiting during pregnancy with a valid and reliable tool. Pregnancy-Unique Quantification of Emesis (PUQE-24) is a reliable tool for assessing the severity of nausea and vomiting symptoms. The original scale was translated into various languages, its validity and reliability were made in some countries and it was used in many studies.
- **What do the results of this study add?** The present study showed that Pregnancy-Unique Quantification of Emesis (PUQE-24) is valid and reliable for Turkish pregnant women. Thus, the scale can be used as a reliable tool in Turkish population.
- **What are the implications of these findings for clinical practice and/or further research?** As a result of this study, Pregnancy-Unique Quantification of Emesis (PUQE-24) can be used as a validated tool for the Turkish population during clinical practice by healthcare professionals and researchers, who are evaluating nausea and vomiting during pregnancy. In future studies, it can be used as an objective assessment tool to determine whether an intervention is needed for nausea and vomiting during pregnancy or to reveal whether the intervention has worked.

KEYWORDS

Nausea; pregnancy; PUQE-24; reliability; validity

Introduction

The condition, called nausea and vomiting during pregnancy, morning sickness, emesis gravidarum, and pregnancy disease, is a complaint with varying severity, observed at an incidence of 50–80% in pregnant women (Büyükkurt et al. 2008; Ebrahimi et al. 2009; Birkeland et al. 2015). The complaint of nausea and vomiting during pregnancy usually starts in the 5th week since the last menstrual period and reaches its peak in the 8th–12th weeks. It then decreases spontaneously and disappears before the 16th week. The complaint of nausea and vomiting continues throughout the entire pregnancy in a very small part of pregnant women (Büyükkurt et al. 2008; Ebrahimi et al. 2009). Hyperemesis gravidarum, which progresses with vomiting at a severity that requires hospitalisation and causes weight loss and dehydration, is observed in approximately 0.3–2% of pregnant women (Birkeland et al. 2015; Bülbül et al. 2017). The cause of nausea and vomiting during pregnancy has not been fully explained yet and is accepted not to depend on a single factor (Kamalak et al. 2015). There are hormonal changes, immunological causes, nutritional disorders, psychological causes, and genetic causes among the reasons (Cevrioğlu and Koçak 2004). The severity of symptoms and onset time vary from individual to individual, and they may also differ in different pregnancies of the same individual. Since its cause is not known exactly, treatment aims at eliminating symptoms (Sucu 2009). Nausea and vomiting are an important health problem that impairs the quality of life of pregnant women. Nausea and vomiting affect the mother adversely physiologically, as well as psychologically and socially (Bustos et al. 2017). A woman suffering from nausea and vomiting often has a sense of isolation, loneliness, and guilt. She may even resort to abortion, thinking that pregnancy cannot continue under unbearable conditions (Mete and Gökçe 2007).

Koren et al. (2002) prepared the Pregnancy-Unique Quantification of Emesis and Nausea (PUQE) test (Koren et al. 2002). The PUQE test questions the length of nausea attacks,

CONTACT Tulay Yilmaz tyilmaz@istanbul.edu.tr Faculty of Health Sciences, Department of Midwifery, Istanbul University-Cerrahpaşa, Istanbul, Turkey

the rate of vomiting and retching within 12 h (Koren et al. 2005). Afterward, Ebrahimi et al. (2009) created the Pregnancy-Unique Quantification of Emesis (PUQE-24) scale, which could also cover 12 h of sleep time and could adequately detect the length and severity of nausea and vomiting. They reported that questioning symptoms in the last 24 h was better in managing nausea and vomiting during pregnancy and predicting results (Ebrahimi et al. 2009). Also Koren and Cohen (2021) reported that PUQE could predict severe nausea and vomiting.

The Pregnancy-Unique Quantification of Emesis and Nausea (PUQE) scale was translated into various languages, such as French (Lacasse et al. 2008), Spanish (Ebrahimi et al. 2009), Italian (Maina et al. 2014), Norwegian (Birkeland et al. 2015), and Korean (Choi et al. 2018), and its validity and reliability studies were carried out in some countries. Ebrahimi et al. (2009) developed the original scale in 2009 and performed the validation of the PUQE-24, which evaluates the last 24 h instead of the last 12 h. The Turkish validation of this scale, which can be used quickly and easily to evaluate nausea and vomiting during pregnancy, has not been performed yet.

This study aims to conduct a validity and reliability study of the Turkish version of the 'Pregnancy-Unique Quantification of Emesis (PUQE-24)' scale that evaluates nausea and vomiting in pregnant women.

Methods

Design

In this methodological study, PUQE-24 was translated from English to Turkish, and then the reliability and validity of the version translated were examined. The sample of the study consisted of live single pregnancies, who spoke Turkish, were married, over 18 years of age, in week 16 or less of gestation, and who applied to the pregnant follow-up polyclinics of a university hospital between March and June 2019. Based on the assumption that it would be more reliable to include at least 20 participants per item in the scale (Kline 2013), 90 pregnant women were included in the sample of the study. Pregnant women with chronic diseases and who did not want to participate in the study were excluded from the study.

Translation procedure

Permission was obtained from Neda Ebrahimi to adapt the Pregnancy-Unique Quantification of Emesis (PUQE-24) scale to Turkish. The translation-back translation method was used in this study. A pilot study was performed with 20 pregnant women to evaluate whether the Turkish version of the scale was understood or not. After the pilot study, the Turkish version of the scale was finalised (Seçer 2018).

Data collection procedures

The pregnant women participating in the study were taken to a room suitable for interviews in the clinic. The Personal Information Form and the Turkish version of PUQE-24 were applied by a researcher to 90 pregnant women using the self-report method (Dennis and Faux 1999). Furthermore, the Visual Analog Scale (VAS), used in many studies to evaluate the severity of nausea and vomiting during pregnancy (Vutyavanich et al. 2001; Sripramote and Lekhyananda 2003; Ensiyeh and Sakineh 2009; Ozgoli et al. 2009; Narenji et al. 2012; Pasha et al. 2012; O'Donnell et al. 2016; Abdolhosseini et al. 2017), was used to evaluate concurrent validity. All pregnant women were called by phone one week later for a retest, and it was ensured that they filled in the scale again.

Data collection instruments

The pregnant women were asked to fill in the 'Personal Information Form', 'Pregnancy-Unique Quantification of Emesis (PUQE-24)', and 'Visual Analog Scale (VAS)'. It took 5-10 minutes for pregnant women to fill in these forms. All pregnant women were re-interviewed over the phone one week later for a retest. Permission was obtained from pregnant women for this interview.

Personal information form

This questionnaire contains 16 questions about the demographic characteristics of pregnant women and variables that may potentially affect nausea and vomiting and is developed based on the literature (Ebrahimi et al. 2009; Choi et al. 2018).

Pregnancy-Unique quantification of emesis (PUQE-24)

The Pregnancy-Unique Quantification of Emesis (PUQE-24) scale was developed by Ebrahimi et al. in 2009, and its validation was performed. This measurement tool was firstly developed by Koren et al. (2002) with a form evaluating nausea and vomiting for the last 12 hours, specific to the pregnancy period, and its validation was carried out in 2005 (Ebrahimi et al. 2009). Afterward, it was reported that it would be more appropriate to evaluate the last 24 h in terms of clinical use, since the last 12 h also sometimes include the sleep period, in terms of nausea and vomiting in pregnant women (Ebrahimi et al. 2009). PUQE-24 is a reliable tool to evaluate the severity of nausea and vomiting symptoms (Ebrahimi et al. 2009). It is considered to be a valuable tool in terms of its simplicity of use and specificity of nausea and vomiting symptoms (Ebrahimi et al. 2009).

The Pregnancy-Unique Quantification of Emesis (PUQE-24) scale consists of 3 questions, including the 'length of nausea or upset stomach', 'rate of vomiting', and 'rate of retching'. Responses to the questions are scored between 1 and 5. The lowest possible score on the scale is 1, and the highest score is 15. In the evaluation of the PUQE-24 test, if the total score is 3–6, it is considered as mild nausea and vomiting, if the total score is 7–12, it is considered as moderate nausea and

vomiting, and if the total score is 13–15, it is considered as severe nausea and vomiting. The original scale does not have subgroups (Koren et al. 2005; Lacasse et al. 2008; Ebrahimi et al. 2009; Gill 2010; Birkeland et al. 2015). Cronbach's alpha value of the Norwegian version of the scale is .846 (Birkeland et al. 2015).

Visual analog scale (VAS)

VAS has been used in many studies to evaluate the severity of nausea and vomiting during pregnancy (Vutyavanich et al. 2001; Sripramote and Lekhyananda 2003; Ensiyeh and Sakineh 2009; Ozgoli et al. 2009; Narenji et al. 2012; Pasha et al. 2012; O'Donnell et al. 2016; Abdolhosseini et al. 2017).

In this study, it was also found appropriate to use VAS simultaneously with PUQE-24 to evaluate the severity of nausea and vomiting. The visual analog scale consists of a 10 cm line. Patients grade their symptoms between 0 and 10, where 0 is evaluated as no symptoms and 10 is evaluated as excessive symptoms (Price et al. 1983; Cline et al. 1992).

Data analysis

Data were analysed using SPSS Version 21 (SPSS Inc., Chicago, IL). Mean, standard deviation, frequencies, and percentages were used as descriptive statistics in the analysis of the study data. The content validity index was used for the validity analysis of the Turkish version of the scale, the exploratory factor analysis and comparison of known groups were used to test construct validity (testing the hypothesis), and the PUQE-24 and VAS agreement methods were used for criterion-related validity. The evaluation was performed with item analysis, internal consistency reliability coefficient, and test and retest method for the reliability analysis of the Turkish version of the scale.

Ethical considerations

Permission for the use of PUQE-24 was obtained from Neda Ebrahimi, who developed the scale, by e-mail for adaptation of the Pregnancy-Unique Quantification of Emesis (PUQE-24) scale to Turkish. The ethics committee approval (59491012-604.01.02) and written permission from the institution where the study would be conducted were obtained from Clinical Research Ethics Committee of Istanbul University Cerrahpaşa Faculty of Medicine. The written permission from the hospital, where data would be conducted, was obtained before the study. Furthermore, the pregnant women who agreed to participate in the study were informed about the study, and it was stated that the information would be kept confidential.

Results

Characteristics of participants

The mean age of the women participating in the study was found to be 30.32 ± 0.61 (min:19, max:43) years, and the education level of more than half of them (54.4%) was above 8 years. It was determined that the majority of the participants had a nuclear family (87.8%), were not employed (68.9%), and had income equivalent to their expenses (85.6%).

In the study, 60% of the pregnant women stated that their nausea and vomiting increased mostly due to the smell of food, and 31.1% indicated that they consulted the doctor due to nausea and vomiting (Table 1).

Reliability and validity analysis for PUQE-24 in the Turkish population

Results of the validity analysis

Content validity index. The language equivalence stage of the study is explained in the methods section. After the language validity of the scale was assessed, the Turkish version of the scale was given to nine experts, and their opinions were obtained to determine content validity. To evaluate the measurement degree of each item, they were asked to score the items between 1 and 4 (1 point: Not suitable at all, 2 points: Slightly suitable, 3 points: Suitable, 4 points: Very suitable). The differences of opinion among the experts were examined by the Lawshe technique, and the data obtained from the experts were evaluated with the Content Validity Index (CVI). The statements were finalised by taking into account the small change suggestions from the experts for the accepted items. As a result, the Content Validity Index (CVI) of the scale was calculated as $p = .96$, and the expert responses were observed to be compatible.

Construct validity: Exploratory factor analysis results. Before applying the exploratory factor analysis, the Kaiser-Meyer-Olkin (KMO) test was conducted to test whether the sample size was suitable for factor analysis. As a result of the analysis, the KMO value was determined to be .680. In line with this result, it was concluded that the sample adequacy was 'sufficient' for factor analysis. While the KMO value between 0.5 and 1.0 was considered as acceptable, values below 0.5 were indicators that factor analysis was not suitable for the data set in question (Aksayan and Gözüm 2003; Seçer 2018; Alpar 2018). Furthermore, when Bartlett's test of sphericity results evaluating whether the data set was suitable for normal distribution were examined, the obtained value (p) = .000 was observed to be acceptable (Seçer 2018).

In the exploratory factor analysis conducted to reveal the factor pattern of the PUQE-24 scale, it was determined that the scale had a single-factor structure explaining 65.968% of the total variance. The factor load values of the PUQE-24 scale were found to be between 0.776 and 0.831 (Table 2).

Comparison of known groups to test construct validity (testing the hypothesis). When evaluating the degree of nausea and vomiting in pregnant women by the PUQE Assessment Tool, no pregnant women with a lot of nausea and vomiting (min: 13–max: 15) were determined, and it was identified that the mean score of pregnant women with moderate levels of nausea and vomiting was 8.78 ± 1.63 (min: 7–max: 12) and the mean score of pregnant women with low

Table 1. Distribution of the participants' characteristics ($n = 90$).

Variables	Number (n)	Percentage (%)
Status of Having Children		
There are	49	54.4
There are not	41	45.6
Status of Pregnancy Planning		
Planned	65	72.2
Not planned	25	27.8
Factors Increasing Nausea and Vomiting During Pregnancy		
Food smell	54	60.0
Fatigue	20	22.2
Cigarette smell	15	16.7
Standing	13	14.4
Deodorant smell	4	4.4
Air temperature	2	2.2
Status of Consulting the Doctor due to Nausea and Vomiting		
Yes	28	31.1
No	62	68.9
	Mean ± SD	Min–Max
Number of pregnancies	2.25 ± 1.49	1–9
Week of gestation	11.65 ± 3.05	5–16
Week of the onset of nausea and vomiting during pregnancy	5.50 ± 3.68	1–16

Table 2. Results of the validity analysis.

Exploratory factor analysis results of the PUQE-24 scale

Scale Items	Communalities (Common Variance)	Factor loads
PUQE-24 1	.603	.831
PUQE-24 2	.690	.829
PUQE-24 3	.687	.776
Reliability	.718	
Explained Variance (%)	65.968	
Eigenvalue (Λ)	1.979	

Correlation coefficients between the PUQE-24 scale and the VAS score

Scale Sub-Dimensions and Items PUQE-24	VAS total score	
	r	p
Question 1 score (length of nausea)	.74	.000
Question 2 score (rate of vomiting)	.73	.000
Question 3 score (rate of retching)	.73	.000
PUQE-24 Total	.90	.000

PUQE-24: Pregnancy-Unique Quantification of Emesis and nausea-24; VAS: Visual Analog Scale; r: Pearson's correlation test; $p < .001$.

levels of nausea and vomiting was 4.10 ± 1.17 (min: 1–max: 6). The difference between the groups with moderate and mild levels of nausea and vomiting was quite significant ($p < .000$).

Criterion-related validity: PUQE-24 and VAS agreement. The concurrent similar scale validity method was used for the criterion-related validity method. VAS was used to evaluate the concurrent validity of the PUQE-24 Assessment Tool. Since VAS had been previously used simultaneously in the Korean version (Choi et al. 2018), its compatibility with the scale was tested. Relationships between the PUQE-24 items and the total score and the VAS total scores are presented in Table 2.

When the criterion-related validity between the PUQE-24 items and total scores and the VAS score was examined, a positive and strong statistically significant relationship (Pearson $r = .90$ $p = .000$) was detected between both scales (Table 2). It was determined that both scales measured the same values. As the PUQE-24 Assessment Tool scores increased, the VAS scores of pregnant women also increased.

Results of the reliability analysis

Item analysis

The item-total score correlations of the PUQE-24 Assessment Tool are given in Table 3. When the item-total score correlations of three items were examined for the reliability study of PUQE-24, a positive and statistically significant relationship was determined between the reliability coefficients ($r = 0.75$–0.85; $p < .001$) (Table 3).

Internal consistency reliability coefficient

In the analysis conducted for internal consistency in the reliability study of PUQE-24, Cronbach's alpha reliability coefficient was determined to be $\propto = 0.75$ for the overall scale (Tablo 4).

Test and retest method

In testing the time invariance of PUQE-24 adapted to Turkish, test-retest measurements performed at a one-week interval with 90 pregnant women were evaluated with the Pearson moment-product correlation and t-test. When the relationship between the scores obtained in the first and second application of the PUQE-24 scale and its items and the VAS score was examined with Pearson's correlation analysis, the reliability coefficient between the two measurement scores performed for the PUQE-24 scale and three items was calculated in the range between .47 and .99, and the correlation related to the VAS score was calculated to be .80. A positive, strong and statistically highly significant relationship was determined between the two measurements of the PUQE-24 and VAS score ($p < .001$, Table 3). When the mean scores obtained from the test and retest by the participants were compared with the dependent samples t-test (Paired

Table 3. Results of the reliability analysis.

Item-sub-dimension total score correlations of the PUQE-24 scale ($n = 90$)

Scale sub-dimensions and items PUQE-24	Item-total correlation coefficients		Cronbach's Alfa
	r	*p*	∝
Question 1 score (length of nausea)	.85	.000	
Question 2 score (rate of vomiting)	.83	.000	
Question 3 score (rate of retching)	.75	.000	
			.75

Comparison of the test and retest mean scores of the PUQE-24 scale and its sub-dimensions and correlations ($n = 90$) ($p < .05$)

Scale and Its Sub-Dimensions	First Application Mean ± SD	Second Application Mean ± SD	*t*	*p*	*r*	*p*
1. Question 1 score (length of nausea)	2.18 ± 1.28	1.93 ± 1.00	**3.332**	**.001**	.827	.000
2. Question 2 score (rate of vomiting)	1.64 ± 0.98	1.58 ± 0.92	.609	.544	.590	.000
3. Question 3 score (rate of retching)	1.66 ± 0.89	1.53 ± 0.67	1.833	.070	.475	.000
4. PUQE-24 score	5.50 ± 2.52	5.05 ± 2.13	**2.770**	**.007**	.997	.000
5. VAS score	3.70 ± 3.38	3.31 ± 3.10	**2.394**	**.018**	.800	.000

PUQE-24 score severity	*n*	%	*n*	%	X^2	*p*
Mild (score 3-6)	60	87.0	3	14.3	**39.295**	**.000**
Moderate (score 7–12)	9	13.0	18	85.7		
Severe (score 13–15)	–	–	–	–		

t: Paired Samples t-test, *r*: Pearson's correlation test, X^2: Chi-Square; PUQE-24: Pregnancy-Unique Quantification of Emesis – 24; VAS: Visual Analog Scale.

t-test), a statistically significant difference was detected between the VAS score, PUQE-24 total score, and Question 1 'length of nausea' mean scores ($p < .05$, Table 3). A statistically significant difference was found between the first and second application according to the severity of the PUQE-24 scale (mild and moderate). In the second application, the rate of those with moderate nausea and vomiting was higher in comparison with the first application ($p < .001$, Table 3). It is thought that this may be due to the memory factor because of the application of the scale to pregnant women one week later.

Discussion

PUQE-24 is a tool that provides monitoring of nausea and vomiting for 24 h in terms of quality and quantity, as well as ensuring that early precautions are taken for this problem experienced in pregnancy. This study presents more pieces of evidence for the international applicability of PUQE-24. Therefore, the results of the psychometric study are consistent with the original study (Ebrahimi et al. 2009) and provide evidence that the Turkish version of PUQE-24 may be a valid and reliable tool.

Validity study for the assessment tool

Validity is defined as the degree to which a measurement tool can accurately measure the feature aimed to be measured directly without comparing it with any other feature (Alpar 2018; Seçer 2018).

Content validity index

The recruited experts reviewed the items in terms of content validity and agreed on the fact that the scale exhibited good content validity in its original form. The high degree of inter-rater agreement is an important finding for verifying the content validity of the Turkish version of PUQE-24.

Construct validity: exploratory factor analysis results

In the exploratory factor analysis conducted to reveal the factor pattern of the PUQE-24 scale, it is observed that the scale has a single-factor structure. Furthermore, it is reported in the literature that the items of a measurement tool must have a factor load value of at least 0.32 and above (Seçer 2018). When evaluated from this perspective, it was determined that the factor load values of the PUQE-24 scale were above 0.50.

Comparison of known groups to test construct validity (testing the hypothesis)

One of the methods used to determine construct validity is to examine construct validity with the help of group differences. These groups are the groups created for the rating of the test to be validated and thought to be different (Alpar 2018). In the analysis conducted, a significant difference between the groups in terms of the scores obtained from PUQE-24 indicates that the ratings of the test are appropriate.

Criterion-related validity: PUQE-24 and VAS agreement

Criterion-related validity is to test the score or information obtained from a measurement tool by comparing it with an external criterion (Seçer 2018). Compatibility with the VAS scale was tested to evaluate the concurrent validity of the PUQE-24 scale. Concurrent validity was determined with the correlation between the PUQE-24 and VAS scores. In terms of

concurrent validity, the consistency of the evaluations related to nausea and vomiting experiences of pregnant women with the scores in the Turkish version of PUQE-24 confirms the scale (Table 2). A strong relationship between the Turkish version of PUQE-24 and the VAS scores demonstrated that there was an agreement and that this new Turkish version of the tool could measure the targeted structure in a valid way (Seçer 2018).

Results of the reliability analysis

Among the conditions that an assessment tool should meet, there are similarity, proximity, and stability of the results obtained from different measurements. The fact that the results obtained from different measurements are the same is an indicator of the reliability of the results and that the results are not accidental (Seçer 2018).

Item analysis

The procedures performed to determine the contribution of the items on the scale to the scale are called item analysis (Alpar 2018). This analysis was conducted to test whether the scale elements matched the structure of nausea and vomiting assessment. The reliability of the Turkish version of the PUQE-24 scale in item analysis was observed to be very high (Table 2).

Internal consistency reliability coefficient

It is generally accepted that Cronbach's alpha value should be at least .70 and above in scale studies (Seçer 2018). In this study, Cronbach's alpha of the scale was evaluated, and it was revealed that the scale was reliable (Table 2).

Test-retest method

In general, a high correlation value obtained from the test-retest application in scale development processes indicates that reliability is provided (Seçer 2018).

Considering the psychometric properties of the Turkish version of PUQE-24, it can be concluded that the scale is a reliable and valid measurement tool that can be used by healthcare professionals to evaluate the degree of nausea and vomiting in pregnant women.

Limitations of the study

The limitation of the study was that it was conducted across the pregnant population of a single university hospital.

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