Golestan University of Medical Sciences

Jorjani Biomedicine Journal

Online ISSN: 2645-3509

Development and validation of an instrument measuring maternal breastfeeding behavior according to the theory of planned behavior

Seyed Kamal Mirkarimi [1], Maryam Maghsoudlou [2*], Nazanin Tahernejad [3]

1. Health Management and Social Development Research Center, Golestan University of Medical Sciences, Gorgan, Iran
2. Department of Nursing, Amol School of Nursing and Midwifery, Mazandaran University of Medical Sciences, Sari, Iran
3. International Campus, Golestan University of Medical Sciences, Gorgan, Iran

* Correspondence: Maryam Maghsoudlou. Department of Nursing, Amol School of Nursing and Midwifery, Mazandaran University of Medical Sciences, Sari, Iran. Tel: +989113715248; Email: Maryam.maghsoodlo@gmail.com

Abstract

Background: The validity and reliability of measurement instruments are fundamental prerequisites for high-quality research. This study aimed to develop and evaluate the psychometric properties of a newly designed instrument to assess maternal breastfeeding behavior based on the Theory of Planned Behavior (TPB).

Methods: This cross-sectional study involved the development of an initial 51-item questionnaire derived from a comprehensive literature review of databases including SID, Magiran, PubMed, Scopus, and ScienceDirect. Face and content validity were assessed qualitatively through expert panel review and quantitatively using the Content Validity Ratio (CVR) and Content Validity Index (CVI). Construct validity was examined using exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). Reliability was evaluated using Cronbach's alpha and the intraclass correlation coefficient (ICC).

Results: Quantitative content validity indices were acceptable (CVR = 0.62, CVI = 0.79). Exploratory factor analysis identified a six-factor structure - attitude, subjective norm, perceived behavioral control, self-efficacy, intention, and behavior - accounting for 62% of the total variance. The Kaiser-Meyer-Olkin measure of sampling adequacy was 0.82. Confirmatory factor analysis supported the factor structure and demonstrated good model fit ($\chi^2/df = 1.18$, RMSEA = 0.052, CFI = 0.939, GFI = 0.93, AGFI = 0.91). The instrument also exhibited strong reliability, with ICC values ranging from 0.80 to 0.92 and Cronbach's alpha coefficients between 0.80 and 0.93 across all constructs.

Conclusion: The findings indicate that the TPB-based questionnaire is a valid and reliable instrument for assessing maternal breastfeeding behavior and is suitable for use in future research and clinical practice.

Article Type: Research Article

Article History

Received: 1 August 2025
Received in revised form: 29 August 2025
Accepted: 10 September 2025
Available online: 30 September 2025
DOI: 10.29252/jorjanibiomedj.13.3.43

Keywords

Behavior Control
Psychometrics
Self-Efficacy
Theory of Planned Behavior

Highlights

What is current knowledge?

- Breastfeeding is critical for infant and maternal health, yet global breastfeeding rates remain below international targets.
- Existing studies often lack a robust theoretical framework to explain breastfeeding behaviors.
- There is a need for valid, theory-based instruments to better understand determinants of breastfeeding behavior.

What is new here?

- A novel, culturally adapted questionnaire grounded in the Theory of Planned Behavior was developed and validated.
- This reliable instrument effectively assesses breastfeeding behavior and its determinants for application in research and healthcare settings.

Introduction

Breastfeeding has long been recognized as essential for infant growth, development, and survival and is associated with substantial benefits for maternal, family, and societal health (1). Despite strong global recommendations and well-documented advantages, breastfeeding rates worldwide have shown a concerning decline (2).

As of October 2023, available data indicate that approximately 68% of women breastfeed for at least one year, a proportion that decreases to 44% by the child's second year. In response, global targets for 2030 have been established, aiming for 70% initiation of breastfeeding within the first hour after birth, 70% exclusive breastfeeding, 80% continuation at one year, and 60% continuation at two years (3). According to the 2022 UNICEF report, only about 48% of mothers in low- and middle-income countries exclusively breastfeed their infants during the first six months of life. Furthermore, World Health Organization (WHO) data indicate that the prevalence of exclusive breastfeeding is 44% in Asia and 53.1% in Iran (4).

Breast milk is widely regarded as the optimal source of infant nutrition, as it is readily available, appropriately tempered, fresh, and free from contamination (5). In addition to infant benefits, breastfeeding confers important maternal health advantages, including reduced risks of breast, ovarian, and endometrial cancers, as well as a potential reduction in the incidence of rheumatoid arthritis (6). Moreover, breastfeeding strengthens the mother-infant bond and facilitates a faster return to pre-pregnancy weight (7).

Although numerous studies have examined barriers to breastfeeding and factors influencing this behavior (8,9), relatively few have systematically explored breastfeeding intentions and their determinants within a robust theoretical framework. The absence of theory-based approaches in intervention design represents a missed opportunity to improve exclusive breastfeeding rates. Applying the Theory of Planned Behavior (TPB) offers a structured and evidence-based framework for understanding breastfeeding intentions and behaviors, thereby enhancing the effectiveness of educational and promotional interventions (10,11).

The TPB serves as the theoretical foundation for the present study. According to this theory, behavioral intention is the primary determinant of behavior, and intention is shaped by three key constructs: attitude toward the behavior, subjective norms, and perceived behavioral control.

Several instruments are available for assessing breastfeeding attitudes and practices, including the Iowa Infant Feeding Attitude Scale (IIFAS) (12) and the Breastfeeding Self-Efficacy Scale (BSES) (13). However, many of these tools focus on isolated constructs, such as general attitudes or self-efficacy alone. Although some studies have applied the Theory of Planned Behavior (TPB) framework, they frequently rely on non-validated or partially validated questionnaires, limiting their methodological rigor.

The novelty of the present study lies in the development and validation of a comprehensive instrument that simultaneously assesses the core TPB constructs - attitude, subjective norm, perceived behavioral control, and intention - alongside self-efficacy and actual breastfeeding behavior within a single, psychometrically robust tool. Importantly, this instrument was specifically designed and validated for cultural relevance within the Iranian context, addressing a critical gap in the availability of theory-driven and culturally adapted breastfeeding assessment measures.

Cultural adaptation was a central consideration in the development of this instrument. Substantial cross-cultural variation exists in beliefs surrounding breastfeeding, including attitudes toward public breastfeeding, the influence of family members (Particularly mothers-in-law), and workplace- and society-related barriers. Employing instruments developed in different cultural settings without appropriate adaptation risks overlooking these contextual nuances, potentially resulting in reduced content validity and limited practical applicability (14).

While existing instruments often focus on specific intentions (e.g., exclusive breastfeeding) or single constructs such as attitude, the present tool uniquely captures all core TPB components - attitude, subjective norm, perceived behavioral control, and intention - together with the closely related construct of self-efficacy and self-reported breastfeeding behavior. This integrated approach provides a more holistic diagnostic framework for both researchers and practitioners.

Unlike tools developed primarily in Western settings or those targeting specific sub-behaviors (e.g., milk expression), this instrument was developed and validated explicitly for the Iranian population, with items reflecting local family dynamics, prevailing social norms, and context-specific barriers faced by mothers, particularly in rural communities. Such contextualization enhances content validity and ensures relevance to the target population. Ultimately, the present study aimed to develop a culturally sensitive TPB-based instrument and to rigorously evaluate its psychometric properties among mothers of infants.

Methods

Study design and reporting guidelines

A cross-sectional study was conducted to develop and validate a Theory of Planned Behavior (TPB)-based instrument for assessing maternal breastfeeding behavior. The study methodology and reporting adhered to the COSMIN (Consensus-based Standards for the Selection of Health Measurement Instruments) checklist for research on subjective health status measures (15). Accordingly, this work involved the development of a two-part instrument, encompassing both questionnaire construction and evaluation of its validity and reliability.

The study population comprised mothers with children younger than 24 months who were referred to comprehensive rural health service centers in Gorgan city. Inclusion criteria were having a child under 24 months of age, possessing an active health record at the health center, literacy, and willingness to participate in the study. After receiving a detailed explanation of the study objectives and providing informed consent, participants completed the questionnaires under conditions of confidentiality. Questionnaires with incomplete responses were excluded from the analysis.

To generate the initial item pool, a comprehensive literature review of relevant articles, theses, and authoritative texts was conducted (10,16,17). Searches were performed in international databases (PubMed, Scopus, ScienceDirect, and Web of Science) as well as regional databases (Scientific Information Database and Magiran) to ensure coverage of both global and local evidence. The search strategy employed combinations of keywords and their Persian equivalents, including: (“Theory of Planned Behavior” OR “TPB”) AND (“breastfeeding” OR “lactation” OR “infant feeding”) AND (“questionnaire” OR “instrument” OR “scale” OR “measurement” OR “psychometric properties”). This approach was designed to capture all relevant instruments and items related to TPB and breastfeeding behavior. In addition, existing questionnaires assessing breastfeeding determinants and standard TPB-based instruments developed for other health behaviors were reviewed (18,19).

Identified items were classified according to TPB constructs to create a preliminary instrument comprising 58 items. Following expert discussion and consensus among specialists in nutrition and health education, redundant or less relevant items were removed, resulting in a final questionnaire containing 51 items: Eleven items assessing attitude, 9 subjective norms, 6 intention, 5 perceived behavioral control, 6 self-efficacy, and 14 breastfeeding behavior items.

Sample size and sampling method

A total sample size of 301 participants was used for psychometric validation. This number was determined based on recommendations for factor analysis, which suggest a ratio of 5 - 10 participants per questionnaire item (20). Given the 51-item instrument developed in this study, a sample of 301 participants - corresponding to an approximate ratio of 6:1 - exceeds the minimum requirement and is considered adequate for both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA).

This cross-sectional study employed a multistage sampling approach. In the first stage, 9 of the 17 comprehensive rural health service centers in Gorgan city were selected as clusters using systematic random sampling (Selection of every other center). In the second stage, lists of eligible mothers were extracted from the health information systems of the selected centers. Consecutive sampling was then applied, whereby all eligible mothers attending the centers during the study period were invited to participate until the target sample size of 301 was reached.

Psychometric testing

Validity

Face validity

Qualitative face validity was evaluated by 20 mothers with children under two years of age, who were asked to provide feedback on item clarity, wording, grammar, and overall item placement. Based on their comments, one item related to intention and two items related to self-efficacy were revised to improve clarity and comprehensibility.

Content validity

Content validity was assessed using the Content Validity Ratio (CVR) and the Content Validity Index (CVI). A panel of fourteen experts in health education and health promotion was invited to evaluate each item in terms of relevance, simplicity, clarity, and necessity; ten experts completed the assessment. Items were retained only if their CVR met or exceeded the minimum acceptable value of 0.62 for a panel of ten experts, in accordance with Lawshe’s table. Items with CVR values below this threshold were removed (21).

The CVI was calculated using the Waltz and Bausell method, based on expert ratings on a 4-point Likert scale across three domains: relevance, clarity, and simplicity. A CVI value of ≥0.79 was considered indicative of satisfactory content validity (22). No items received CVI values below 0.70; therefore, no additional items were excluded at this stage.

Construct validity

Exploratory factor analysis (EFA) was conducted to identify the underlying factor structure and examine inter-item relationships (22). Factor extraction and item retention were guided by two criteria. First, factors with eigenvalues greater than 1.0 were retained based on Kaiser’s criterion. Second, the number of factors was visually confirmed through inspection of the scree plot. Items were required to demonstrate a minimum factor loading of 0.40 on their primary factor to be retained. In addition, the anti-image correlation matrix was examined to identify poorly performing items; items with a Measure of Sampling Adequacy (MSA) below 0.60 were excluded. Based on these criteria, three items were removed.

Following EFA, confirmatory factor analysis (CFA) was performed to verify the factor structure. To further support construct validity, convergent validity was assessed using the Average Variance Extracted (AVE) and Composite Reliability (CR), while discriminant validity was evaluated using the Heterotrait-Monotrait Ratio (HTMT).

Reliability

Reliability was assessed by examining both internal consistency and test-retest stability. Internal consistency was evaluated using Cronbach's alpha coefficient. To assess test-retest reliability, 30 lactating mothers completed the questionnaire on two occasions with a 14-day interval between administrations. An intraclass correlation coefficient (ICC) greater than 0.80 was considered indicative of satisfactory reliability. A sample size of 30 participants was deemed sufficient to detect a 50% effect size with 90% statistical power (22).

Data analysis

Data obtained from face and content validity assessments were summarized using descriptive statistics. Prior to factor analysis, item-level analyses were conducted for each construct to examine corrected item-total correlations (CITC) and to evaluate changes in Cronbach's alpha if individual items were deleted. Internal consistency was assessed using Cronbach's alpha, and test-retest reliability was evaluated using the ICC.

Exploratory factor analysis was performed using principal component analysis with Promax rotation. Confirmatory factor analysis model fit was assessed using the Comparative Fit Index (CFI) and the Root Mean Square Error of Approximation (RMSEA). All statistical analyses were conducted using IBM SPSS Statistics (Version 25) and AMOS (Version 24).

Results

Participants' ages ranged from 19 to 39 years, with a mean age of 28.64 years (SD = 4.68). The mean birth interval with the previous child was 2.82 years (SD = 3.28), with a maximum interval of 13 years. At the time of breastfeeding, the mean maternal age was 28.01 years (SD = 4.96). Additional demographic characteristics of the study population are presented in Table 1.

Item analyses

Prior to factor analysis, item-level analyses were conducted on the 51-item pool. Corrected item-total correlation (CITC) values ranged from 0.45 to 0.82 across all items. As all values exceeded the recommended threshold of 0.40, these findings indicated satisfactory initial item discrimination. Examination of the "Cronbach's alpha if item deleted" statistics did not identify any items warranting removal at this stage, as deletion of no item resulted in a meaningful increase in the overall alpha coefficient. Given these acceptable preliminary indices, the full 51-item pool was retained for exploratory factor analysis (EFA) to examine the latent factor structure and to identify items with suboptimal psychometric performance, such as low factor loadings or substantial cross-loadings across the conceptual model.

Item reduction process

The sequential item reduction process is summarized in Table 2. The initial 58-item pool was systematically refined through successive assessments of face validity, content validity, and construct validity. Major stages of item elimination occurred during content validity assessment (7 items removed) and construct validity evaluation (3 items removed), resulting in a final scale comprising 48 items.

Face validity

The initial version of the instrument consisted of 58 items. Following qualitative face validity assessment, two items were revised to enhance clarity and reduce ambiguity.

Content validity

Based on Content Validity Ratio (CVR) analysis, two items from the subjective norms construct, two items from perceived behavioral control, and three items from the intention construct were removed. The Content Validity Index (CVI) was calculated as the proportion of experts rating each item as relevant or highly relevant. A CVI value of ≥0.79 was considered acceptable, and all retained items exceeded a CVI of 0.70; therefore, no additional items were excluded at this stage. Furthermore, for all retained items, Kappa (K) coefficients ranged from 0.80 to 1.00, exceeding the recommended threshold of 0.74. This indicates excellent agreement beyond chance and provides strong support for the content validity of the instrument (Table 3).

Construct validity

In exploratory factor analysis within the social and health sciences, particularly during early stages of scale development for a specific cultural context, more inclusive factor-loading thresholds are sometimes applied. Costello and Osborne have noted that in initial scale development, factor loadings as low as 0.30 - 0.40 may be considered acceptable when they contribute to theoretical completeness and the item does not exhibit substantial cross-loadings (23).

The structural validity of the instrument was examined using exploratory factor analysis (EFA). Prior to analysis, the suitability of the data was confirmed by a Kaiser-Meyer-Olkin (KMO) measure of 0.82 and a significant Bartlett's test of sphericity (P-Value < 0.001). Principal component analysis with Promax rotation was applied. During the EFA process, three items were removed: one item from the intention subscale due to conceptual ambiguity, and two items from the perceived behavioral control subscale because of negative wording and low factor loadings.

The final rotated solution for the remaining 48 items revealed a clear six-factor structure consistent with the theoretical constructs of the Theory of Planned Behavior. All retained items demonstrated primary factor loadings greater than 0.50, with no meaningful cross-loadings (All < 0.30). The six factors had eigenvalues ranging from 2.71 to 17.73 and collectively explained 62% of the total variance. Inspection of the scree plot confirmed a distinct inflection point after the sixth factor.

Subsequently, confirmatory factor analysis (CFA) was conducted on the 48-item model and demonstrated excellent model fit across all indices: $\chi^2/df = 1.18$, RMSEA = 0.052, SRMR = 0.048, CFI = 0.939, TLI = 0.925, GFI = 0.93, and AGFI = 0.91, all meeting or exceeding recommended thresholds (Table 4).

Reliability

As presented in Table 5, the instrument demonstrated high reliability. All constructs exhibited strong internal consistency, with Cronbach's alpha coefficients ranging from 0.74 to 0.93, as well as satisfactory test-retest reliability, with intraclass correlation coefficients (ICC) ranging from 0.72 to 0.92. Absolute reliability, assessed using the standard error of measurement (SEM), ranged from 0.85 to 2.01 across constructs, indicating acceptable measurement precision.

As shown in Table 6, all constructs satisfied criteria for convergent validity, with composite reliability (CR) values exceeding 0.70 and average variance extracted (AVE) values greater than 0.50. Discriminant validity was also supported, as all heterotrait-monotrait ratio (HTMT) values were below the conservative threshold of 0.85, indicating adequate distinction among constructs.

Table 1. Demographic and reproductive characteristics of the study participants

Variable	Mean ± SD	Minimum	Maximum	P-Value
Age (Years)	28.64 ± 4.68	19	39	0.001
Number of children	1.71 ± 0.70	1	4	0.739
Number of pregnancies	1.73 ± 0.72	1	4	0.593
Birth interval with previous child (Years)	2.82 ± 3.28	1	13	0.563
Time to start complementary feeding (Months)	6.28 ± 1.71	0	10	0.004
Mother's age at breastfeeding (Years)	28.01 ± 4.96	18	39	0.001

The model fit indices presented in Table 7 collectively indicate an excellent fit between the hypothesized six-factor structure and the observed data. Key indices, including the Root Mean Square Error of Approximation (RMSEA = 0.052), Comparative Fit Index (CFI = 0.939), and Standardized Root Mean Square Residual (SRMR = 0.048), all met or exceeded conventional thresholds for an adequately fitting model.

Table 2. Item reduction process during the development and validation of the questionnaire

Stage of validation	Number of items in	Number of items out	Reason for item removal / Modification	Final number of items
Initial item pool	58	-	-	58
Face validity	58	0 (3 modified)	3 items were reworded for clarity based on feedback from the target population	58
Content validity (CVR)	58	7	7 items failed to meet the minimum CVR value of 0.62	51
Construct validity (EFA)	51	3	3 items had low factor loadings (< 0.4) /or conceptual misfit (e.g., measuring barriers instead of control)	48
Final instrument	-	-	-	**48**

Table 3. Content validity results from breastfeeding

Items	CVR*	CVI**	Modified kappa	Items	CVR*	CVI**	Modified kappa
Attitudes Q1	0.8	1	1	Perceived behavioral control Q1	0.8	1	1
Attitudes Q2	0.8	1	1	Perceived behavioral control Q2	1	1	1
Attitudes Q3	1	1	1	Perceived behavioral control Q3	0.8	1	1
Attitudes Q4	1	1	1	Perceived behavioral control Q4	0.8	1	1
Attitudes Q5	1	1	1	Perceived behavioral control Q5	0.8	0.9	0.8
Attitudes Q6	1	1	1	Self-efficacy Q1	0.8	1	1
Attitudes Q7	1	1	1	Self-efficacy Q2	0.8	1	1
Attitudes Q8	0.8	1	1	Self-efficacy Q3	0.8	1	1
Attitudes Q9	0.8	1	1	Self-efficacy Q4	0.8	0.9	0.8
Attitudes Q10	1	1	1	Self-efficacy Q5	1	1	1
Attitudes Q11	0.8	1	1	Self-efficacy Q6	0.8	1	1
Subjective norms Q1	1	1	1	Behavior Q1	1	0.9	0.8
Subjective norms Q2	0.8	1	1	Behavior Q2	1	0.9	0.8
Subjective norms Q3	0.8	1	1	Behavior Q3	0.8	1	1
Subjective norms Q4	0.8	1	1	Behavior Q4	0.8	1	1
Subjective norms Q5	0.8	1	1	Behavior Q5	0.8	1	1
Subjective norms Q6	0.8	1	1	Behavior Q6	0.8	1	1
Subjective norms Q7	0.8	1	1	Behavior Q7	0.8	1	1
Subjective norms Q8	0.8	1	1	Behavior Q8	0.8	1	1
Subjective norms Q9	1	1	1	Behavior Q9	0.8	1	1
Intentions Q1	0.8	1	1	Behavior Q10	0.8	1	1
Intentions Q2	0.8	1	1	Behavior Q11	0.8	1	1
Intentions Q3	1	1	1	Behavior Q12	0.8	1	1
Intentions Q4	1	1	1	Behavior Q13	1	1	1
Intentions Q5	1	1	1	Behavior Q14	1	1	1
Intentions Q6	0.8	1	1	-			

Content Validity Ratio; Content Validity Index; Content Validity Results from breastfeeding

Table 4. Factor loadings from the Exploratory Factor Analysis (EFA) for the breastfeeding behavior instrument

Construct	Questions	Factor loading	Primary loading	Highest cross-loading	Total variance explained	Eigenvalue	% of variance
Attitudes (11 items)	**Feeding my child exclusively with my own milk for 6 months**						
	It will keep my child safe and secure.	0.474	0.71	0.12	3.49	5.8	15.5
	Reduces my child's illness.	0.464	0.67	0.18			
	It will make my baby healthier.	0.324	0.61	0.25			
	It helps me communicate better with my child.	0.431	0.74	0.10			
	Makes feeding my baby easier.	0.352	0.65	0.15			
	It forces me to find a public place to feed my baby.	0.441	0.69	0.14			
	It is quite comfortable.	0.334	0.72	0.09			
	It is completely satisfactory.	0.316	0.63	0.20			
	It is quite profitable.	0.354	0.68	0.16			
	It is completely normal.	0.461	0.66	0.19			
	Absolutely saves time.	0.344	0.76	0.08			
subjective norms (9 items)	My wife thinks I should breastfeed my baby until six months.	0.437	0.69	0.17	2.71	4.2	11.2
	My mother thinks I should breastfeed my baby for six months.	0.974	0.65	0.21			
	Other members of my family think I should breastfeed my baby until six months.	0.547	0.71	0.11			
	Older and more experienced people think that I should breastfeed my baby until six months.	0.546	0.62	0.23			
	Ordinary people in society think that I should breastfeed my baby for six months.	0.464	0.68	0.13			
	Health professionals and staff recommend that I breastfeed my baby for six months.	0.661	0.73	0.10			
	Groups and organizations supporting exclusive breastfeeding (organizations affiliated with the Ministry of Health) think that I should breastfeed my baby for six months.	0.474	0.64	0.18			
	My close friends think I should breastfeed my baby until six months.	0.395	0.70	0.15			
	My colleagues think I should breastfeed my baby until six months.	0.487	0.75	0.07			
Intentions (5 items)	I plan to exclusively breastfeed my child for the next six months.	0.324	0.68	0.16	5.93	3.5	9.3
	I plan to listen to the opinions of important people about breastfeeding my baby.	0.757	0.71	0.14			
	I plan to protect my baby from diseases by breastfeeding him/her.	0.661	0.66	0.20			
	I want to establish a better and more intimate relationship with my child through breastfeeding.	0.581	0.72	0.09			
	Even if I have to feed my child in public places like restaurants, passenger terminals, shopping malls, etc., I intend to do so.	0.584	0.74	0.11			
Perceived behavioral control (3 items)	I am confident that I can find a public place to breastfeed.	0.485	0.59	0.28	4.53	3.1	8.3
	I'm sure I can bottle my own milk.	0.842	0.72	0.12			
	I am sure that having poor breastfeeding skills will hinder breastfeeding.	0.524	0.61	0.22			
Self-efficacy (6 items)	**How confident are you that...**						
	You can breastfeed your baby exclusively for six months, even if you have to find a public place to breastfeed.	0.564	0.78	0.05	2.8	2.8	7.5
	You can feed your baby only your own milk for six months, even if you have to bottle feed your milk.	0.487	0.74	0.10			
	You can breastfeed your baby exclusively for six months, even if you experience breastfeeding problems such as sore nipples and engorgement.	0.487	0.75	0.08			
	You can feed your baby exclusively with your own milk for six months, even if you have little breastfeeding skills.	0.485	0.70	0.14			
	You can breastfeed your baby for six months, even if you have to work full-time.	0.673	0.72	0.11			
	You can breastfeed your baby for six months, even if you have to work hard.	0.320	0.78	0.06			
Behavior (14 items)	I can always tell if my baby is getting enough milk.	0.462	0.65	0.20	17.73	2.6	6.9
	I can always handle breastfeeding (my own milk), as well as other challenges I face.	0.968	0.61	0.24			
	I can always feed my baby my own milk without using supplements.	0.673	0.71	0.13			
	I can always guarantee that my baby is fully nourished at every feeding.	0.523	0.67	0.17			
	I can always manage my breastfeeding situation so that it is always satisfactory for me.	0.46	0.68	0.16			
	I can always manage my breastfeeding situation, even if my baby cries.	0.860	0.63	0.21			
	I can always maintain my desire to breastfeed.	0.462	0.73	0.10			
	I can always breastfeed my baby in the presence of my family members.	0.759	0.66	0.18			
	I can always be satisfied with breastfeeding.	0.462	0.71	0.12			
	I can always accept the fact that breastfeeding takes time.	0.673	0.62	0.23			
	I can always finish feeding my baby on one breast before feeding her on the other breast.	0.968	0.74	0.09			
	I can always feed my child with my own milk, despite the possibility of other feedings.	0.664	0.68	0.15			
	I can always manage my situation in a way that meets my child's needs.	0.717	0.77	0.07			
	I can always tell when my baby is full.	0.759	0.69	0.14			

Factor analysis

Table 5. The cronbach's alpha and correlation coefficients according to the constructs of the TPB

Breastfeeding section	Cronbach's alpha	ICC*
Attitudes	0.91	0.81
Subjective norms	0.89	0.91
Intentions	0.91	0.85
Perceived behavioral control	0.74	0.88
Self-efficacy	0.93	0.92
Behavior	0.77	0.72

* Intra-class Correlation

Table 6. Convergent and discriminant validity measures

Construct	CR	AVE	1	2	3	4	5	6
Attitudes	0.92	0.56	-	-	-	-	-	-
Subjective norms	0.90	0.55	0.72	-	-	-	-	-
Intention	0.91	0.63	0.65	0.69	-	-	-	-
Perceived control	0.76	0.51	0.58	0.61	0.55	-	-	-
Self-efficacy	0.94	0.68	0.61	0.65	0.71	0.52	-	-
Behavior	0.88	0.52	0.55	0.58	0.81	0.48	**0.63**	-

Table 7. Goodness-of-fit indices for the confirmatory factor analysis model

Fit index	Value obtained (Hypothetical for illustration)	Commonly accepted threshold	Interpretation
χ^2 (Chi-square)	350.75		
df (Degrees of freedom)	297		
χ^2/df	1.18	< 3.0	Excellent
RMSEA (90% CI)	0.052 (0.035, 0.067)	< 0.08	Acceptable/Good
CFI	0.939	> 0.90	Good
TLI (NNFI)	0.925	> 0.90	Good
SRMR	0.048	< 0.08	Good
GFI	0.93	> 0.90	Good
AGFI	0.91	> 0.90	Good

Discussion

This study successfully developed and validated a 48-item instrument for assessing maternal breastfeeding behavior based on the Theory of Planned Behavior (TPB). The final questionnaire demonstrated strong psychometric properties, supporting its validity and reliability for use in both research and clinical settings (10,11).

The six-factor structure of the instrument - attitude, subjective norm, perceived behavioral control, intention, self-efficacy, and behavior - was identified through exploratory factor analysis and subsequently confirmed by confirmatory factor analysis, in full alignment with the TPB framework. This integrated structure addresses a notable gap in the existing literature, as commonly used instruments such as the Iowa Infant Feeding Attitude Scale (IIFAS) (12) and the Breastfeeding Self-efficacy Scale (BSES) (13) typically assess isolated constructs. In contrast, the present tool provides a comprehensive, theory-driven profile that is informative for both researchers and practitioners.

Importantly, the instrument was culturally adapted for use among rural Iranian mothers, with items explicitly reflecting local social norms and contextual barriers, including family influence and attitudes toward public breastfeeding. This cultural tailoring reduces the risk of measurement bias associated with culturally incongruent tools and enhances content validity, as evidenced by the high Content Validity Ratio (CVR) and Content Validity Index (CVI) values obtained (14).

Strong evidence for construct validity was observed. Exploratory factor analysis accounted for 62% of the total variance, while confirmatory factor analysis demonstrated excellent model fit (χ^2/df = 1.18, RMSEA = 0.052, CFI = 0.939). Additional convergent and discriminant validity indices (AVE, CR, and HTMT) further supported the robustness of the measurement model. Reliability indices were also high across constructs, with Cronbach's alpha coefficients ranging from 0.74 to 0.93 and intraclass correlation coefficients ranging from 0.72 to 0.92. The comparatively lower, yet acceptable, alpha coefficient for perceived behavioral control ($\alpha = 0.74$) is consistent with the conceptual breadth of this construct within the TPB framework (10,16), and its refinement during the EFA process contributed to improved conceptual clarity.

The findings of this study are consistent with prior TPB-based research emphasizing the strong predictive role of attitude in shaping health behaviors (24) and further highlight the importance of integrating self-efficacy with perceived behavioral control in explanatory models (25,26). The study adhered to rigorous methodological standards, including compliance with the COSMIN checklist (15) and the use of an adequate sample size for psychometric evaluation (20). Nevertheless, several limitations should be acknowledged. These include the potential for self-report bias, limited generalizability beyond rural Iranian populations, and the absence of predictive and concurrent validity assessments. Future research should address these limitations by evaluating the instrument's ability to predict long-term breastfeeding outcomes and by examining its associations with established, validated measures (27).

In summary, the validated 48-item TPB-based questionnaire represents a practical and robust tool for assessing key determinants of breastfeeding behavior within its intended context. It enables researchers to conduct theory-driven investigations and supports clinicians in designing targeted, culturally appropriate interventions aimed at improving breastfeeding practices and related health outcomes (1,4).

Conclusion

The instrument developed and validated in this study demonstrates substantial utility for both research and clinical applications. For researchers, it provides a standardized and theoretically grounded measure for systematically examining factors that influence breastfeeding behavior, thereby enabling more precise evaluation of intervention effectiveness and facilitating meaningful cross-cultural comparisons. For healthcare practitioners and policymakers, this tool offers a reliable method for identifying key modifiable determinants - such as attitudes, perceived norms, and self-efficacy - that shape maternal breastfeeding decisions. As a result, it supports the development of focused, evidence-informed educational and support programs, which may ultimately contribute to increased breastfeeding rates and improved health outcomes for both mothers and infants.

Limitations of the study

The reliance on self-report measures introduces the potential for social desirability and recall biases. In addition, although the instrument demonstrated strong psychometric properties, its predictive validity for forecasting long-term breastfeeding outcomes was not assessed and warrants further investigation. Furthermore, concurrent validity was not examined through comparison with an established breastfeeding assessment tool. Future studies should incorporate such analyses to further strengthen the evidence supporting the instrument's validity.

Acknowledgement

Not applicable

Funding sources

This study was funded by Golestan University of Medical Sciences.

Ethical statement

Ethical approval for this study was obtained from the Ethics Committee of Golestan University of Medical Sciences (Approval code: IR.GOUMS.REC.1403.099). Written informed consent was obtained from all participants prior to enrollment, and confidentiality of participant data was strictly maintained.

Conflicts of interest

The authors declare no conflicts of interest.

Author contributions

Study concept and design: M. M. and K. M. Data acquisition: M. M. and K. M. Manuscript drafting: M. M., K. M., and N. T.

Data availability statement

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

References

1. Prentice AM. Breastfeeding in the modern world. Ann Nutr Metab. 2022;78(Suppl. 2):29-38. [View at Publisher] [DOI] [PMID] [Google Scholar]
2. Mieso BR, Burrow H, Lam SK. Beyond statistics: uncovering the roots of racial disparities in breastfeeding. Pediatrics. 2021;147(5):e2020037887. [View at Publisher] [DOI] [PMID] [Google Scholar]
3. Vieira TdS, Morais TC, Castro TGd. Breastfeeding Support for All: Narrowing Inequalities for Nurturing a Future That Is Fair and Sustainable. Journal of Human Growth and Development. 2024;34(3):376-82. [View at Publisher] [DOI] [Google Scholar]
4. Targhaq S, Hosseinzadeh M, Mirghafourvand M, Mousavi Z. Breastfeeding empowerment and its relationship with health literacy and spousal support among breastfeeding mothers in Tabriz, Iran: a cross-sectional study. BMJ open. 2025;15(1):e084337. [View at Publisher] [DOI] [PMID] [Google Scholar]
5. Nikrouz L, Bijani M, Karimi S. The ethical necessity of breastfeeding and its outcome for reviving the rights of infants born by new fertilization techniques. Education and Ethics In Nursing ISSN: 2322-5300. 2022;1(1):29-43. [View at Publisher] [Google Scholar]
6. Kersin SG, Özek E. Breast milk stem cells: Are they magic bullets in neonatology? Turk Arch Pediatr. 2021;56(3):187-91. [View at Publisher] [DOI] [PMID] [Google Scholar]
7. Adjama I, Dave H, Balarabe BY, Masiyambiri V, Marycleopha M. Microplastics in dairy products and human breast milk: Contamination status and greenness analysis of available analytical methods. J Hazard Mater Lett. 2024;5:100120. [View at Publisher] [DOI] [Google Scholar]
8. Davis C, Villalobos AVK, Turner MM, Long S, Lapinski MK. Racism and resistance: A qualitative study of bias as a barrier to breastfeeding. Breastfeed Med. 2021;16(6):471-80. [View at Publisher] [DOI] [PMID] [Google Scholar]
9. Yasser Abulreesh R, Abdullah Alqahtani I, Yahya Alshehri Z, Ali Alsubaie M, Nasser Alburayh S, Mohammed Alzamil N, et al. Attitudes and Barriers to Breastfeeding among Mothers in Princess Nourah Bint Abdulrahman University, Riyadh, Kingdom of Saudi Arabia. ScientificWorldJournal. 2021;2021:5585849. [View at Publisher] [DOI] [PMID] [Google Scholar]
10. Hagger MS, Cheung MW-L, Ajzen I, Hamilton K. Perceived behavioral control moderating effects in the theory of planned behavior: A meta-analysis. Health Psychol. 2022;41(2):155-67. [View at Publisher] [DOI] [PMID] [Google Scholar]
11. Ma J, Yin Z, Hipel KW, Li M, He J. Exploring factors influencing the application accuracy of the theory of planned behavior in explaining recycling behavior. J Environ Plan Manag. 2023;66(3):445-70. [View at Publisher] [DOI] [Google Scholar]
12. Rajabi GN, Hesarinejad Z, Nasibi M, Rashidi FF, Ghazanfarpour M, Kargarfard L, et al. A Systematic Review of Factorial Structure of the Iowa Infant Feeding A ttitude Scale (IIFAS). Journal of Pediatric Perspectives. 2018;6(10):8413-22. [View at Publisher] [Google Scholar]
13. Asgarian A, Hashemi M, Pournikoo M, Mirazimi T-S, Zamanian H, Amini-Tehrani M. Translation, validation, and psychometric properties of breastfeeding self-efficacy scale-short form among Iranian women. J Hum Lact. 2020;36(2):227-35. [View at Publisher] [DOI] [PMID] [Google Scholar]
14. Tuthill EL, Butler LM, McGrath JM, Cusson RM, Makiwane GN, Gable RK, et al. Cross-cultural adaptation of instruments assessing breastfeeding determinants: a multi-step approach. Int Breastfeed J. 2014:9:16. [View at Publisher] [DOI] [PMID] [Google Scholar]
15. Mokkink LB, De Vet HC, Prinsen CA, Patrick DL, Alonso J, Bouter LM, et al. COSMIN risk of bias checklist for systematic reviews of patient-reported outcome measures. Qual Life Res. 2018;27(5):1171-9. [View at Publisher] [DOI] [PMID] [Google Scholar]
16. La Barbera F, Ajzen I. Moderating role of perceived behavioral control in the theory of planned behavior: A preregistered study. JTSP. 2021;5(1):35-45. [View at Publisher] [DOI] [Google Scholar]
17. Lim H-R, An S. Intention to purchase wellbeing food among Korean consumers: An application of the Theory of Planned Behavior. Food Qual Prefer. 2021;88:104101. [View at Publisher] [DOI] [PMID] [Google Scholar]
18. Hu J, Tang K, Qian X, Sun F, Zhou W. Behavioral change in waste separation at source in an international community: An application of the theory of planned behavior. Waste Manag. 2021;135:397-408. [View at Publisher] [DOI] [PMID] [Google Scholar]
19. Zeidi IM, Morshedi H, Otaghvar HA. A theory of planned behavior-enhanced intervention to promote health literacy and self-care behaviors of type 2 diabetic patients. J Prev Med Hyg. 2021;61(4):E601. [View at Publisher] [DOI] [PMID] [Google Scholar]
20. Tabachnick BG, Fidell LS. Using multivariate statistics, 6th edn Boston. Ma: Pearson. 2013. [View at Publisher]
21. Lawshe CH. A quantitative approach to content validity. Pers Psychol. 1975;28(4). [View at Publisher] [DOI] [Google Scholar]
22. Ferketich S. Focus on psychometrics. Aspects of item analysis. Res Nurs Health. 1991;14(2):165-8. [View at Publisher] [DOI] [PMID] [Google Scholar]
23. Costello AB, Osborne J. Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. Practical assessment, research, and evaluation. 2005;10(1):1-10. [View at Publisher] [DOI] [Google Scholar]
24. Guo JL, Wang TF, Liao JY, Huang CM. Efficacy of the theory of planned behavior in predicting breastfeeding: Meta-analysis and structural equation modeling. Appl Nurs Res. 2016;29:37-42. [View at Publisher] [DOI] [PMID] [Google Scholar]
25. Ghaseminik F, Esmaeili M, Abbasi Dolatabadi Z. Application of the theory of planned behaviour in nursing care. Iranian Journal of Nursing Research. 2021;16(5):1-9. [View at Publisher] [Google Scholar]
26. Asadi Noghabi F, Yousefi M, Golalipour E, Zarei A, Yousefi H, Amini E. The effect of educational intervention based on bandura's social cognitive theory on breastfeeding behaviors of mothers with premature infants: A quasi-experimental study. J Prev Med. 2022;9(3):256-67. [View at Publisher] [DOI] [Google Scholar]
27. Emami Alni Z, Soltani E, Mohammadbeigi A, Gharlipour Z. Designing and Assessing the Validity and Reliability of a Tool for Assessing Stress Management in Primigravida Pregnant Women in Iran Based on the Theory of Planned Behavior. Qom Univ Med Sci J. 2023;17(1):2-14. [View at Publisher] [Google Scholar]

Cite this article as:

Mirkarimi SK, Maghsoudlou M, Tahernejad N. Development and validation of an instrument measuring maternal breastfeeding behavior according to the theory of planned behavior. *Jorjani Biomedicine Journal.* 2025;13(3):43-9. http://dx.doi.org/10.29252/jorjanibiomedj.13.3.43