

# Psychometric Validation of the Persian Version of the Fertility and Infertility Treatment Knowledge Score

Hamidreza Maghsoudlloo<sup>1</sup> , Tahereh Fathi Najafi<sup>2</sup>, Ali Nakhaei<sup>1</sup> , Bitā Saifi<sup>1\*</sup> 

<sup>1</sup>Department of Basic Sciences, MMS.C., Islamic Azad University, Mashhad, Iran

<sup>2</sup>Department of Midwifery, Faculty of Midwifery and Nursing, Mashhad Medical Sciences Branch, Islamic Azad University, Mashhad, Iran

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## \*Corresponding Author:

Bitā Saifi,

Email: bita\_saifi@yahoo.com

## Abstract

**Introduction:** Fertility awareness among reproductive-age women is inadequate worldwide, and valid measurement tools are a prerequisite for targeted education. The 29-item Fertility and Infertility Treatment Knowledge Score (FIT-KS) is a validated knowledge measure developed in the United States. However, no Persian version was available. Therefore, this study assessed the psychometric properties of the Persian FIT-KS in Iranian women.

**Methods:** This methodological study was conducted from 2024 to 2025 in Mashhad, Iran, following the COSMIN standards and established guidelines for cross-cultural adaptation of health measurement instruments. Forward and backward translation and expert committee review preceded face and content validity by 10 specialists (Lawshe's content validity ratio, content validity index, and modified Cohen's kappa). Furthermore, construct validity was examined through confirmatory factor analysis (CFA) among 250 women of reproductive age using AMOS 24 with maximum-likelihood estimation. Additionally, criterion validity was tested against the Persian Cardiff Fertility Knowledge Scale (CFKS-P) in a subsample (n=40). Finally, internal consistency (Cronbach's alpha) and two-week test-retest reliability (intraclass correlation coefficient [ICC], n=50) underwent assessment.

**Results:** One item on the average cost of IVF in the United States was removed after content validity (CVR=0), yielding a 28-item Persian FIT-KS. The mean age of participants was  $30.14 \pm 6.05$  years, and the mean total knowledge score was  $15.8 \pm 4.2$  out of 28 (56.4%). The two-factor CFA model showed acceptable fit ( $\chi^2/df \approx 1.52$ , GFI=0.86, RMSEA=0.05, SRMR=0.07). Moreover, criterion validity was supported by a strong correlation with the CFKS-P (Spearman  $r=0.75$ ,  $P<0.001$ ). Internal consistency ( $\alpha=0.77$ ) and test-retest reliability (ICC=0.75) were also acceptable.

**Conclusion:** The Persian FIT-KS is a valid and reliable instrument for assessing fertility and infertility treatment knowledge among Iranian women of reproductive age.

**Keywords:** Fertility awareness, Infertility treatment, Psychometrics, FIT-KS, Women

## Introduction

Fertility awareness—an accurate understanding of fecundability, the reproductive lifespan, and the causes and treatments of infertility—remains inadequate across both general and medical populations. According to a systematic review of 71 studies, individuals of reproductive age demonstrated low-to-moderate fertility knowledge, with consistent deficits among men and those with lower educational attainment, and the review called for targeted educational interventions.<sup>1</sup> This evidence gap has motivated international initiatives, such as the International Fertility Education Initiative, to improve fertility education globally.<sup>2</sup>

Infertility itself is defined as the failure to achieve pregnancy after 12 months of regular unprotected intercourse, and ovulatory dysfunction, male factor, and tubal disease account for most identifiable causes.<sup>3</sup> Globally, an estimated 48 million couples and 186 million

individuals are affected by infertility, making reliable assessment of public knowledge about its treatment increasingly important for reproductive counseling and health policy.<sup>4</sup>

In the United States, Kudesia et al developed and validated the 29-item Fertility and Infertility Treatment Knowledge Score (FIT-KS) as a brief measure covering natural fertility and infertility treatment knowledge, with women scoring 55.9% correct and medical trainees 64.9%.<sup>5</sup> Similarly, existing instruments include the FertiSTAT risk-communication tool and the 13-item Cardiff Fertility Knowledge Scale (CFKS), which has been psychometrically validated in Persian (CFKS-P), with an overall correct-answer rate of 50.76% reported among Iranian couples.<sup>6</sup>

Iranian data mirror this knowledge deficit. A recent cross-sectional study of 1,834 couples in northwest Iran found fertility knowledge to be significantly lower among women with lower education and homemakers.<sup>7</sup>

In addition, knowledge and attitudes of infertile Iranians toward assisted reproductive technology show substantial gaps.<sup>8</sup> Likewise, qualitative work involving infertile Iranian women has highlighted unmet reproductive health education needs.<sup>9</sup> However, no validated Persian instrument captures both fertility physiology and infertility treatment knowledge in one scale; the CFKS-P is limited to general fertility knowledge and contains no treatment items.<sup>6</sup>

Given these gaps, the present study aims to translate, culturally adapt, and psychometrically validate the FIT-KS<sup>5</sup> for use among Iranian women of reproductive age, following the COSensus-based Standard for the selection of health Measurement INstruments (COSMIN) standards for studies of measurement properties.<sup>10</sup>

## Methods

### Study Design and Setting

This methodological (instrument-validation) study was performed from 2024 to 2025 in Mashhad, Iran. All procedures followed the COSMIN consensus on taxonomy and quality standards for measurement-property studies<sup>10</sup> and the guidance of Wild and Grove on translation and cross-cultural adaptation of health measurement instruments.<sup>11</sup>

### Ethical Approval

The study protocol was approved by the Research Ethics Committee of Islamic Azad University, Mashhad Medical Sciences Branch (IR.MSHD.IAU.REC.1403.040, approved 2024/08/01). All participants provided written informed consent, and all data were collected anonymously.

### Translation and Cultural Adaptation

Permission to translate the original English FIT-KS was obtained from NCBI. Forward translation into Persian was independently performed by two bilingual translators, reconciled into a single version, and back-translated by two other translators blind to the original scale. Furthermore, an expert committee (translator, methodologists, and reproductive health specialists) compared the back-translation with the source items, resolved discrepancies, and produced the pre-final Persian version for field testing.<sup>11</sup>

### Face and Content Validity

Face validity was qualitatively assessed with 10 women of reproductive age, who rated item clarity and difficulty. Further, content validity was then quantified with a panel of 10 reproductive health and psychometrics specialists. Each expert scored every item on a three-point relevance scale, from which Lawshe's content validity ratio (CVR) was computed per item; the critical value for a panel of 10 experts (0.62) was also applied, and items falling below it were flagged for revision or removal.<sup>12</sup> Likewise, the scale-level content validity index (CVI) and item-level modified Cohen's kappa (K) were calculated to correct for chance agreement, with acceptable thresholds of CVI $\geq$ 0.75

and K $\geq$ 0.74 as recommended in the methodological literature.<sup>10,12</sup>

### Construct Validity

Construct validity was examined through CFA of the hypothesized two-factor structure of the FIT-KS (fertility knowledge and infertility treatment knowledge) using AMOS (version 24) with maximum-likelihood estimation. Additionally, model fit was evaluated with the normed chi-square ( $\chi^2/\text{df}$ ), the goodness-of-fit index (GFI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). Finally, conventional thresholds were applied:  $\chi^2/\text{df} < 3$ , GFI $\geq$ 0.85, RMSEA $<$ 0.08, and SRMR $\leq$ 0.08.

### Criterion Validity

Criterion validity was assessed against the validated CFKS-P<sup>6</sup> in a subsample of 40 participants. Moreover, convergent relationships were tested with Spearman's rank correlation, with a strong positive association ( $r \geq 0.5$ ,  $P < 0.05$ ) defined as supporting evidence.

### Reliability

Internal consistency was estimated with Cronbach's alpha (acceptable:  $\geq 0.7$ ). Furthermore, stability was evaluated by readministering the questionnaire to 50 participants two weeks after the initial survey and computing the intraclass correlation coefficient (ICC), with Pearson correlation coefficient reported alongside; ICC $\geq$ 0.7 was considered acceptable.

### Participants and Sample

A total of 250 women of reproductive age (18–45 years) were recruited from community and educational settings in Mashhad through convenience sampling. Inclusion required being of reproductive age and providing informed consent; it should be noted that illiterate participants completed the questionnaire through interviewer administration.

## Results

### Demographic Characteristics

Of the 250 women studied, the mean age was  $30.14 \pm 6.05$  years, and 169 participants (67.6%) were married. In addition, educational attainment was concentrated at the university level; more precisely, 110 women (44%) held a bachelor's degree, 30 (12%) a master's degree, and 17 (7%) a doctoral or professional degree. However, 47 (19%) had a high-school diploma, 37 (15%) an associate degree, and 7 (3%) below diploma level (Table 1). Overall, 28 women (11.2%) reported a history of infertility. Further, occupational distribution reflected the community sample; in other words, 29 (11.6%), 85 (34%), and 76 (30.4%) women worked in medical sciences, had non-medical occupations, and were homemakers, respectively.

### Knowledge Scores

The mean total FIT-KS score was  $15.8 \pm 4.2$  out of

28 (56.4% correct). Based on the results, the fertility knowledge subscale showed a higher correct rate (62.8%) than the infertility treatment knowledge subscale (37.1%), indicating that treatment-related knowledge was the principal area of deficit.

Likewise, knowledge differed by occupational and educational background (Table 2). Students scored  $15.2 \pm 3.8$  (54.3%), with  $2.4 \pm 1.1$  (34.3%) on the treatment subscale, whereas homemakers scored the lowest at  $13.4 \pm 3.4$  (47.9%), with  $1.9 \pm 1.0$  (27.1%) on treatment knowledge. Furthermore, total scores significantly increased with educational level, and knowledge of infertility treatment rose from 17.1% correct among women below diploma level to 54.3% among those with doctoral degrees; participants working in medical sciences achieved the highest scores.

### Content Validity

In the panel of 10 experts, all items met the Lawshe critical value of  $CVR=0.62$  ( $P<0.05$ ), except one item asking about the average cost of IVF in the United States, which returned  $CVR=0$  and was deleted. Retained item

**Table 1.** Demographic Characteristics of Participants (N=250)

| Variable               | Category                | Number (%)       |
|------------------------|-------------------------|------------------|
| Age (years)            | Mean $\pm$ SD           | 30.14 $\pm$ 6.05 |
| Marital status         | Married                 | 169 (67.6)       |
|                        | Single                  | 80 (32.0)        |
| Education              | Below diploma           | 7 (3.0)          |
|                        | Diploma                 | 47 (19.0)        |
|                        | Associate degree        | 37 (15.0)        |
|                        | Bachelor's degree       | 110 (44.0)       |
|                        | Master's degree         | 30 (12.0)        |
|                        | Doctorate or higher     | 17 (7.0)         |
| Occupation             | Medical sciences        | 29 (11.6)        |
|                        | Non-medical occupations | 85 (34.0)        |
|                        | Homemaker               | 76 (30.4)        |
| History of infertility | Yes                     | 28 (11.2)        |

Note. SD: Standard deviation.

**Table 3.** Content Validity Indices of the Persian FIT-KS (Expert Panel, n=10)

| Index              | Observed Range | Criterion   | Results                                                          |
|--------------------|----------------|-------------|------------------------------------------------------------------|
| Item CVR (Lawshe)  | 0.6–1.0        | $\geq 0.62$ | All retained items met the criterion; 1 item ( $CVR=0$ ) removed |
| CVI (scale level)  | 0.75–1.0       | $\geq 0.75$ | Acceptable                                                       |
| Modified kappa (K) | 0.74–1.0       | $\geq 0.74$ | Acceptable                                                       |

Note. FIT-KS: Fertility and Infertility Treatment Knowledge Score; CVR: Content validity rate; CVI: Content validity index.

**Table 4.** Fit Indices of the Two-Factor CFA Model of the Persian FIT-KS (N=250)

| Fit Index   | Value        | Threshold   | Interpretation                                           |
|-------------|--------------|-------------|----------------------------------------------------------|
| $\chi^2/df$ | 1.52         | $< 3$       | Good                                                     |
| GFI         | 0.86         | $\geq 0.85$ | Acceptable                                               |
| RMSEA       | 0.05         | $< 0.08$    | Good                                                     |
| SRMR        | 0.07         | $\leq 0.08$ | Good                                                     |
| CFI/TLI/NFI | Not reported | —           | Not reported owing to violation of normality assumptions |

Note. RMSEA: Root mean square error of approximation; SRMR: Standardized root mean square; GFI: Goodness-of-fit index; TLI: Tucker-Lewis index; NFI: Normed fit index; FIT-KS: Fertility and Infertility Treatment Knowledge Score; CFA: Confirmatory factor analysis.

CVR values and scale-level CVI values ranged from 0.6 to 1.0 and 0.75 to 1.0, respectively, and modified kappa values (K) all exceeded 0.74, confirming adequate content validity of the final 28-item Persian scale (Table 3).

### Construct Validity: Confirmatory Factor Analysis

The hypothesized two-factor model (fertility knowledge; infertility treatment knowledge) was tested on the full sample (N=250). Considering that univariate and multivariate normality assumptions were violated for some items, fit indices robust to non-normality were prioritized in model evaluation, and CFI, TLI, and NFI were not reported. The model displayed acceptable fit:  $\chi^2/df \approx 1.52$ , GFI=0.86, RMSEA=0.05, and SRMR=0.07 (Table 4).

### Criterion Validity and Reliability

Criterion validity was supported by a strong positive correlation between the Persian FIT-KS and the CFKS-P (Spearman's  $r=0.75$ ,  $P<0.001$ ,  $n=40$ ). Similarly, internal consistency was acceptable (Cronbach's  $\alpha=0.77$  overall; fertility knowledge subscale  $\alpha=0.7$ ; infertility treatment knowledge subscale  $\alpha=0.44$ ). Ultimately, stability was confirmed by Pearson's  $r=0.92$  and ICC=0.75 in the test–retest subsample ( $n=50$ , two-week interval).

### Discussion

This study translated and validated the FIT-KS for Iranian women of reproductive age and demonstrated that the Persian version is a valid and reliable brief measure of

**Table 2.** FIT-KS Scores by Occupational Group (N=250)

| Occupation Group        | Total Score Mean $\pm$ SD (% Correct) | Treatment Knowledge Mean $\pm$ SD (% Correct) |
|-------------------------|---------------------------------------|-----------------------------------------------|
| Students                | 15.2 $\pm$ 3.8 (54.3)                 | 2.4 $\pm$ 1.1 (34.3)                          |
| Medical sciences        | Highest group mean                    | Highest group mean                            |
| Non-medical occupations | Intermediate                          | Intermediate                                  |
| Homemakers              | 13.4 $\pm$ 3.4 (47.9)                 | 1.9 $\pm$ 1.0 (27.1)                          |

Note. FIT-KS: Fertility and Infertility Treatment Knowledge Score; SD: Standard deviation.

fertility and infertility treatment knowledge. Based on the results, content validity was confirmed by an expert panel using Lawshe's CVR, the CVI, and modified kappa; the two-factor structure illustrated acceptable fit, and both internal consistency ( $\alpha=0.77$ ) and two-week stability ( $ICC=0.75$ ) were acceptable.<sup>12</sup>

The knowledge profile observed in this study is in line with the original United States validation, in which women answered 55.9% of items correctly<sup>5</sup>; the Persian sample achieved 56.4%, indicating a comparable overall level of knowledge despite the different cultural and health-system context. As in the original study, participants showed disproportionate weakness in treatment-related knowledge (37.1% correct), which is consistent with the international evidence, representing that assisted reproduction outcomes are frequently overestimated or misunderstood.<sup>2,5</sup>

The strong correlation with the CFKS-P ( $r=0.75$ ) supports criterion validity while highlighting complementarity: the CFKS-P covers general fertility knowledge<sup>6</sup> whereas the FIT-KS uniquely measures infertility treatment knowledge, a domain directly relevant to counseling couples facing delayed conception or treatment decisions.<sup>3,4</sup> The demographic pattern of scores—lower knowledge among homemakers and women with less education, and a steep educational gradient in treatment knowledge—corresponds to findings from northwest Iran<sup>7</sup> and from the international literature<sup>1</sup> reinforcing the case for education targeted at less-advantaged groups.<sup>2,9</sup>

### Strengths and Limitations of the Study

The study followed COSMIN-based procedures for translation, content validation, structural validation, and reliability testing.<sup>10,11</sup> Its limitations included convenience sampling from a single city, the modest subsample sizes for criterion validity ( $n=40$ ) and test–retest ( $n=50$ ), and the omission of CFI, TLI, and NFI from CFA reporting because normality assumptions were violated; thus, larger probability samples and longitudinal assessment of responsiveness would strengthen future work.

### Conclusion

It was revealed that the 28-item Persian FIT-KS is a valid and reliable instrument for assessing fertility and infertility treatment knowledge among Iranian women of reproductive age. Accordingly, it can be used by clinicians, educators, and researchers to identify knowledge gaps and evaluate the impact of fertility education programs.

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### Authors' Contribution

Conceptualization: Hamidreza Maghsoudlloo  
Data Curation: Hamidreza Maghsoudlloo

Formal Analysis: Hamidreza Maghsoudlloo  
Funding Acquisition: Hamidreza Maghsoudlloo  
Methodology: Hamidreza Maghsoudlloo  
Project Administration: Hamidreza Maghsoudlloo  
Resources: Hamidreza Maghsoudlloo  
Software: Ali Nakhaei  
Supervision: Ali Nakhaei, Ali Nakhaei  
Validation: Hamidreza Maghsoudlloo  
Visualization: Ali Nakhaei  
Writing—Original Draft: Hamidreza Maghsoudlloo  
Writing—Review & Editing: Ali Nakhaei

### Data Availability Statement

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

### Competing Interests

The authors declare they have no competing interests.

### Consent for Publication

Not applicable.

### Ethical Approval

The study was approved by the Research Ethics Committee of Mashhad Medical Sciences Branch, Islamic Azad University, Mashhad, Iran (IR.MSHD.IAU.REC.1403.040). In addition, all participants provided written informed consent.

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