



Psychometric properties of the fertility problem inventory in Spanish infertile patients undergoing assisted reproduction treatments

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Abstract

Infertility affects millions of individuals worldwide, significantly impacting mental health and quality of life. Therefore, it is essential to have valid and reliable score interpretations of measurement tools to study the effects of infertility-related stress on people's lives. This study seeks to undertake the translation and cultural adaptation of the instrument the Fertility Problem Inventory (FPI) into Spanish, assessing its reliability and validity in a sample of 205 heterosexual infertile patients undergoing Assisted Reproductive Treatments (ART). Participants completed an online questionnaire after providing informed consent. Validity evidence based on the internal structure was obtained through Confirmatory Factor Analysis (CFA). In addition, validity evidence based on the relation with other variables was explored by correlations between the FPI with anxiety and depression scales. Internal consistency was also explored. The results indicated that the alternative model of the FPI (two second-order factors) provided a better fit than the first one proposed by Newton et al. (1999) (CFI = 0.95, RMSEA = 0.064) and demonstrated adequate reliability ($\alpha=0.891$ for global stress). A positive association was found between higher levels of infertility-related stress and symptoms of anxiety and depression, particularly concerning the impact of infertility on daily life. This study provides validity evidence of the FPI Spanish version for its use with infertile patients undergoing ART, highlighting the importance of considering social and relational aspects, as well as beliefs about parenthood, in understanding the emotional distress associated with infertility.

Keywords Infertility · Mental health · Fertility problem inventory · Validity · Reliability

Introduction

Millions of people worldwide suffer from infertility, defined as difficulty in achieving pregnancy after 12 months or more of regular unprotected sexual intercourse. Addressing this

condition is vital due to its impact on the health and on the sexual and reproductive rights of those affected (World Health Organization [WHO], 2023), and to assess the influence of Assisted Reproductive Technologies (ART) on patients' quality of life (Mousavi et al., 2013).

Regarding mental health effects, research has indicated a global prevalence of major depressive disorder (clinical depression) in 22.9% of the infertile women studied, with 31.6% exhibiting depressive symptoms. Additionally, 13.3% of these women experience generalized anxiety, and 78.8% report stress (Salari et al., 2024). Infertile men are also affected, with identified rates of 21.37% for anxiety (Simbar et al., 2024) and 18.04% for depression (Kiani et al., 2023). Likewise, cross-cultural evidence suggests that emotional responses to infertility may vary according to sociocultural context, highlighting the influence of social variables—such as environmental support or pressure to have children—on how infertility-related stress is experienced (Giannouli & Stoyanova, 2018).

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Previous research has developed different instruments to measure specific areas of infertility-related stress (e.g., Abbey et al., 1991; Bernstein et al., 1985; Glover et al., 1999). In response to this, Newton et al. (1999) designed the Fertility Problem Inventory (FPI), a multidimensional measure consisting of 46 items that assess infertility-related stress through five domains, in addition to providing a global stress score. These five domains are: (1) social concern (Sensitivity when discussing infertility and social isolation); (2) sexual concern (decreased sexual pleasure and problems with scheduled intercourse); (3) relationship concern (difficulty in discussing infertility and concern about its impact on the relationship); (4) need for parenthood (being a mother/father as the central goal in life); and (5) rejection of a child-free lifestyle (the perception that well-being depends on parenthood and the devaluation of childless life).

As summarized in Table S1 (Supplemental Material), psychometric evaluations of the FPI across cultural contexts show substantial inconsistency. Although some studies support the original five-factor model (Peng et al., 2011), others propose more parsimonious structures, such as the two-factor higher-order solution (Moura-Ramos et al., 2012; Donarelli et al., 2015) or a four-factor model integrating relationship and sexual concerns (Gourounti et al., 2011; Zurlo et al., 2017), the latter also offering a shortened 27-item version (Zurlo et al., 2017). More recently, Patel et al. (2022) introduced a culturally adapted six-factor, 32-item revision. Together, these findings highlight the cultural sensitivity of infertility-related stress and the need for continued validation and refinement of the FPI's factorial structure.

Evidence for the FPI's convergent and discriminant validity has also been examined (Table S1). Most studies report low to moderate intercorrelations among FPI factors or between theoretically distant dimensions (Gourounti et al., 2011; Newton et al., 1999; Peng et al., 2011; Zurlo et al., 2017), with stronger correlations emerging among conceptually related factors (Gourounti et al., 2011; Moura-Ramos et al., 2012). Regarding convergent validity, the FPI has shown consistent associations with anxiety, depression, perceived stress, marital functioning, mood states, and the desire to achieve pregnancy (Donarelli et al., 2015; Gourounti et al., 2011; Moura-Ramos et al., 2012; Newton et al., 1999; Patel et al., 2022; Peng et al., 2011; Zurlo et al., 2017).

Additionally, the reliability of the FPI has been studied in each sample, most often through internal consistency reported by Cronbach's alpha coefficient. In all cases, the indices exceeded the 0.70 threshold for each factor and the global score, except for the study by Patel et al. (2022), which reported lower values ($\alpha=0.52$ to 0.70). Newton et al. (1999) also conducted a Test-Retest analysis with a 30-day interval, observing high correlations between scores, both in men and women.

In Spain, it has been reported that during 2021 a total of 165,453 cycles of In Vitro Fertilization (IVF) and 33,818 cycles of Artificial Insemination (AI) were performed, indicating a progressive increase since records of this type have been maintained (Spanish Fertility Society, 2023a; 2023b). Additionally, statistics revealed that during 2020 births resulting from ART accounted for 11% of total births in Spain. Despite the growing relevance of ART in the Spanish context, no studies have yet examined the psychometric properties of the FPI in this population, leaving a significant gap in available assessment tools. Therefore, the main objective of this research was to translate and to adapt the FPI into Spanish, as well as to obtain evidence of the instrument's reliability and validity for its use in a sample of Spanish women and men diagnosed with infertility and undergoing ART. Specifically, this study aimed to: (I) analyze the items of the FPI; (II) obtain evidence of validity based on the internal structure of the instrument, both by analyzing the first five-factor model proposed by Newton et al. (1999), and the alternative model proposed by Moura-Ramos et al. (2012), which groups these five factors into two second-order factors; (III) obtain evidence of validity based on relations with other variables, specifically anxiety and depression; and (IV) explore the reliability (internal consistency) in the study sample.

Method

Participants and study design

The study sample consisted of patients from the assisted human reproduction unit of a public hospital in southern Spain. The inclusion criteria for participation in this study were: (i) to be over 18 years of age, (ii) to be a female ART recipient without children or to be her male or female partner, and (iii) to be fluent in Spanish. Thus, 532 patients initially agreed to participate in the study and received the link to the online questionnaire (285 women undergoing ART and 247 male and female partners). Of this initial sample, 260 responded to the questionnaire, although only 224 people responded to all items of the FPI instrument. It was noted that there was a very small number of single women ($n=6$) and women with female same-sex partners ($n=13$) participating. Therefore, it was decided that the final sample consisted of 205 heterosexual ART patients with partners (142 women and 63 men).

Instruments

Fertility Problem Inventory (FPI; Newton et al., 1999). It is an instrument that measure infertility-related stress

through concerns or beliefs related to infertility using 46 items with a Likert-type response format from 1 (*Strongly disagree*) to 6 points (*Strongly agree*). Higher scores imply greater worries or stressful beliefs about infertility. According to the author of the original scale, the FPI is organized into five dimensions (social concern, sexual concern, relationship concern, rejection of child-free lifestyle and need for parenthood) and a global dimension (infertility global stress). For this study, the adapted and translated Spanish version was used.

Hospital Anxiety and Depression Scale (HADS) (Zigmond y Snaith, 1983; Spanish version of Herrero et al., 2003). This is a screening test composed of 14 items to detect depressive (seven items) and anxious (seven items) symptomatology. The participants must respond using a Likert-type response scale ranging from 0 to 3 points for each item. The intensity of the symptomatology increases the higher score obtained in anxiety and depressive subscales. For the total scale, a reliability coefficient of $\alpha=0.857$ was obtained for this study (women $\alpha=0.843$ and men $\alpha=0.877$). The reliability of the anxiety and depression subscale was $\alpha=0.832$ (women $\alpha=0.833$ and men $\alpha=0.810$) and $\alpha=0.737$ (women $\alpha=0.733$ and men $\alpha=0.742$), respectively.

Procedure

Ethical approval was obtained from the XXXX (blind for reviewers). All ethical guidelines, including the Declaration of Helsinki of the World Medical Association, were followed during the research. The study was carried out in two different phases. In phase 1, the FPI was adapted into Spanish using a back-translation method (Maneesriwongul & Dixon, 2004) carried out by four bilingual experts in medicine and psychology. A pilot study with six patients from the reproductive medicine unit was conducted to assess cultural and conceptual equivalence, and minor wording adjustments were made based on their feedback. For the phase 2, data collection was carried out between June 2021 and November 2021 using an online questionnaire on the Qualtrics platform. Patients were contacted by medical/clinical staff to inform them of this research. During this initial contact, all potential participants were asked whether they had access to the internet and all confirmed that they did. Patients who agreed to participate were sent and individualized, single-use link to the online questionnaire via text message. Each link was uniquely generated through the Qualtrics platform, ensuring that duplicate responses could not be provided. Participants

were again required to provide informed consent within the questionnaire prior to accessing the survey.

Statistical analysis

All analyses were carried out with R Studio (2021.09.3) and Eq. (6.4) software. First, an initial descriptive analysis of the sample was performed by calculating the mean scores and standard deviations of the sociodemographic variables. Differences by gender in sociodemographic and psychological variables were examined using Chi-Squared Test and Student's T-test depending on the type of variable. The Cramer's V and Cohen's d effect sizes were also calculated. Item-level analysis of the FPI included evaluation of skewness and kurtosis coefficients, along with floor and ceiling effects. Confirmatory Factor Analysis (CFA) was conducted using the Robust Maximum Likelihood estimation method to account for the multivariate non-normal distribution of the data (Mardia test = 17.64). The following structures were analysed: (i) the original model proposed by Newton et al. (1999) (Fig. 1) and (ii) an alternative model in which an intermediate level of comprehension is added but without modify the basic structure (Moura-Ramos et al., 2011) (Fig. 2). As an alternative due to the limited sample size, and following Bandalos (2002), three parcels were created for each of the five factors to improve model fit and reduce the number of items. In each created parcel, the items of each factor were randomly assigned (Little et al., 2002). Each parcel was calculated by the mean of the items that have been randomly assigned to it. Model fit was evaluated using: The Satorra-Bentler goodness-of-fit X^2 statistic (X^2 S-B), the Comparative Fit Index (CFI), the Non-Normalized Fit Index (NNFI), the Root Mean Square Error of Approximation (RMSEA) and the Standardized Root Mean Squared Residual (SRMR). According to McDonald and Ho (2002), CFI and NNFI values exceeding 0.90 reflect acceptable model fit, whereas Hu and Bentler (1998) suggest more stringent criteria, with optimal values ≥ 0.95 . RMSEA and SRMR values below 0.06 and 0.08, respectively, are considered indicative of a good model fit. To compare the fit of the original and alternative CFA models, changes in fit indices (Δ CFI and Δ RMSEA) were also examined (Lai, 2019). To provide evidence of external validity based on the relationship with other variables, two complementary approaches were used. First, Pearson correlations were calculated between the FPI factor and the HADS anxiety and depression scores, and partial correlations controlling for gender were also examined. The magnitude of these associations

Fig. 1 Original FPI model (standardized weights)

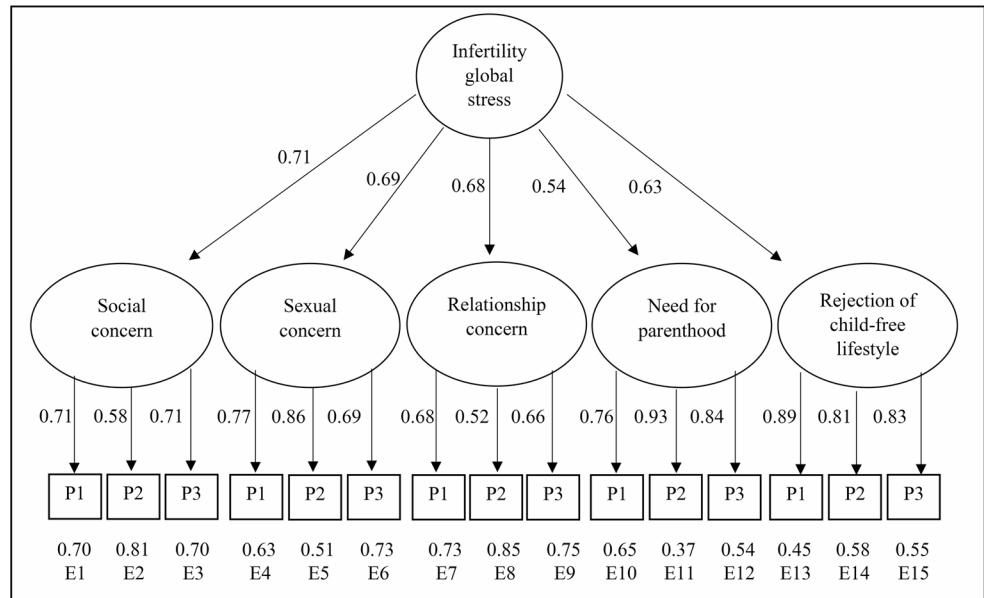
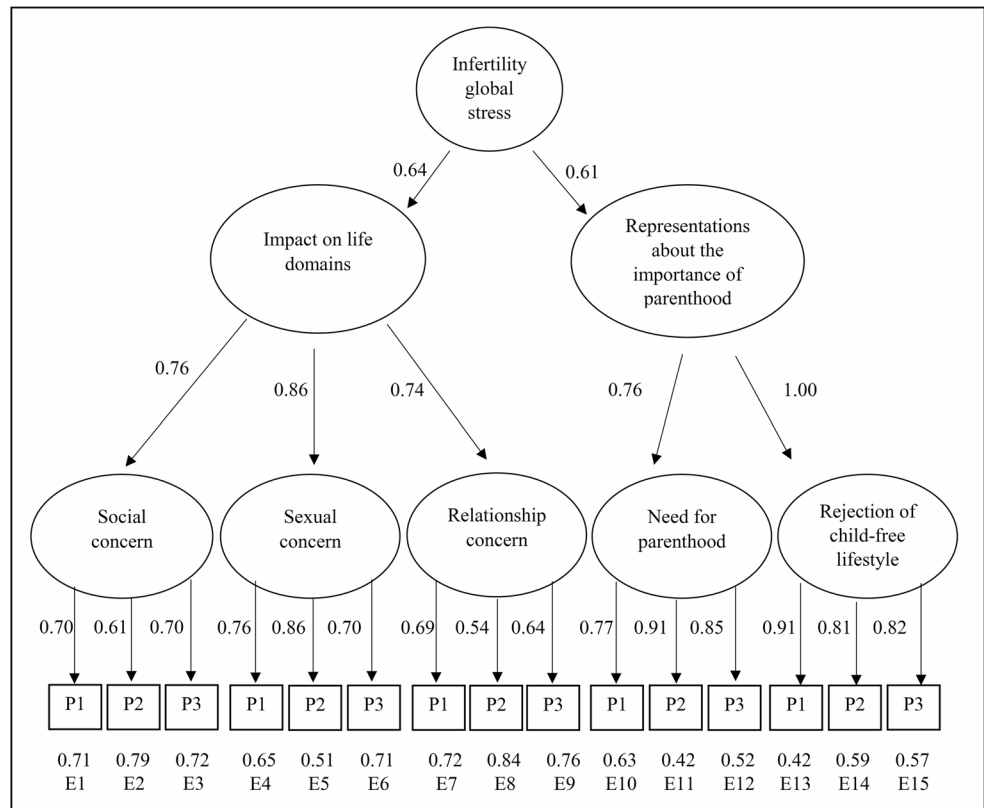


Fig. 2 Alternative FPI model (standardized weights)



was interpreted following Cohen’s benchmarks for effect sizes: approximately 0.10=small; 0.30=medium, and 0.50=large (Cohen, 1988). Second, latent correlations were also estimated within a CFA analysis framework.

Finally, considering the model with the best fit, the item-test correlations and Cronbach’s alpha coefficient were provided to study the internal consistency of the total scale and factors.

Results

Descriptive statistics

The sociodemographic and psychological characteristics of the sample included in this study are shown in Table S2 (Supplemental Material). The mean age of the participants was 36.19 years ($SD=4.07$), with men being older than women ($t=-4.07$; $p < .001$; $d=0.616$). Most of the participants were Spanish born (88.9%) and the majority had completed either secondary (26.3%) or high secondary education (36.6%), while 21.0% held a university degree and 16.1% had completed a Master's or Doctorate. Regarding clinical variables, the mean duration of infertility was 2.67 years ($SD=1.73$; $Mdn=2$), with values ranging from 1 to 12 years (skewness=2.01; kurtosis=5.61). At least one miscarriage was reported by 18.5% ($n=38$) of the participants. As for psychological variables, women reported higher levels of infertility-related stress and anxiety symptoms than men, with small-to-moderate effect sizes (see Table S2).

FPI items analysis

Table 1 shows the means, standard deviation, asymmetry, kurtosis and floor and ceiling effect obtained for each item of the FPI questionnaire. The item with the highest score was item 25 of the dimension need for parenthood, "At times, I seriously wonder if I want a child/another child" ($M=4.57$; $SD=1.77$). The lowest score was obtained for item 24 of the dimension relationship concern "My partner is quite disappointed with me" ($M=1.30$; $SD=0.86$). The skewness and kurtosis value ranged from -0.85 to 3.60 and from -1.77 to 13.75 , respectively. In addition, the majority of the items (86.96%) presented a floor effect (percentages of responses with a score of 1 greater than 15%) while only 17 items presented a ceiling effect.

Evidence based on internal structure (Confirmatory factor Analysis)

The fit indices of the FPI two models studied are shown in Table 2. Results of the first model (original model; Newton et al., 1999) provided poor fit indicators ($X^2S-B=268.01$; $df=85$; $p < .001$; $CFI=0.87$; $NNFI=0.83$; $RMSEA [95\% CI]=0.103 [0.089, 0.116]$; $SRMR=0.130$). The standardized weights (Fig. 1) ranged from 0.525 (Relationship concern/parcel 2) to 0.928 (Need for parenthood/parcel 2). The alternative model showed a notably better fit ($|\Delta CFI|=0.08$; $|\Delta RMSEA|=0.039$) for our sample compared to the original structure ($X^2S-B=152.84$; $df=83$; $p < .001$; $CFI=0.95$; $NNFI=0.94$; $RMSEA [95\% CI]=0.064 [0.048, 0.080]$; $SRMR=0.073$). However, the upper limit of the confidence

interval suggests interpreting the RMSEA estimate with some caution. Figure 2 shows the values of the standardized loads which range between 0.54 (Relationship concern/parcel 2) and 0.91 (Need for parenthood/parcel 2 and Rejection of child-free lifestyle/parcel 1). In addition, standardized residuals matrix was inspected to evaluate local areas of misfit, following Kline (2016). All values were small (largest $|\text{residual}|=0.23$; see Table S3 supplementary material), indicating no need for model re-specification.

Evidence based on relations to other variables (Convergent evidence)

The results about the relationship between FPI and HADS scores (Table 3) showed that higher level of infertility global stress (total score of FPI) was associated with a high presence of anxiety ($r=.349$; $p < .001$) and depression ($r=.340$; $p < .001$) symptoms. Similarly, the impact of infertility on life domains, one of the two second order factors of the alternative model studied, showed a significant and positive correlation with anxiety ($r=.525$; $p < .001$) and depression ($r=.489$; $p < .001$) symptoms. However, no significant associations were found between the factor about the representations about the importance of parenthood in men and women's life and anxiety ($r=.017$; $p=.805$) and depression symptomatology ($r=-.018$; $p=.801$). Partial correlation analysis controlling for gender showed that the pattern of associations between FPI and HADS anxiety and depression remained largely unchanged in magnitude and significance (see Table S4). Similarly, the results of the latent correlation analysis showed moderate to strong positive relationships between social, sexual and relationship concern and both anxiety ($r=.488-0.606$, $p < .001$) and depression ($r=.499-0.575$, $p < .001$). In contrast, rejection of a child-free lifestyle and need for parenthood did not show significant results with the HADS dimensions ($p > .05$ in all cases).

Reliability

Considering the second model studied (alternative model) which showed the best fit, the results about the reliability of the scores, estimated through Cronbach's alpha internal consistency coefficient, are presented in Table 4. The results showed adequate levels for the total scale (Infertility global stress $\alpha=0.891$) and for the two-second order factor ($\alpha=0.851$) for "The impact of infertility on life domains" composed by social, sexual and relationship concern and $\alpha=0.906$ for "Representations about the importance of parenthood in men and women's life domain" composed by rejection of child-free lifestyle and need for parenthood). The reliability coefficients for each subdimension ranged between 0.636 (Relationship concern) to 0.864 (Rejection

Table 1 Descriptive statistics of the fpi's items ($N=205$)

Item	Min-Max	Mean	SD	Skewness	Kurtosis	% of responses with a score of 1	% of responses with a score of 6
Social concern							
9	1–6	2.84	1.72	0.51	−1.01	32.7	11.7
12	1–6	2.26	1.66	1.19	0.09	48.8	9.3
14	1–6	1.83	1.39	1.54	1.22	66.8	2.9
27	1–6	1.96	1.50	1.44	0.87	62.4	4.9
30	1–6	2.99	1.99	0.36	−1.47	41.5	19.0
35	1–6	2.86	1.63	0.49	−0.86	27.8	9.8
39	1–6	2.08	1.62	1.31	0.34	59.5	6.8
40	1–6	2.00	1.50	1.37	0.69	59.5	4.9
43	1–6	1.43	0.99	2.75	7.38	77.6	1.0
44	1–6	2.49	1.92	0.89	−0.85	52.2	15.1
Sexual concern							
3	1–6	2.63	1.81	0.68	−0.98	44.4	12.2
4	1–6	2.55	1.67	0.69	−0.82	42.4	7.8
7	1–6	2.54	1.81	0.85	−0.73	44.9	13.2
13	1–6	2.03	1.53	1.32	0.42	59.5	4.4
17	1–6	2.40	1.73	0.93	−0.52	49.3	9.8
22	1–6	2.00	1.62	1.45	0.69	62.9	7.3
32	1–6	2.26	1.66	1.02	−0.33	54.1	7.3
37	1–6	2.45	1.84	0.86	−0.81	52.2	11.7
Relationship concern							
11	1–6	2.62	1.83	0.69	−1.03	44.4	11.7
16	1–6	2.07	1.50	1.29	0.58	55.6	5.4
18	1–6	1.91	1.29	1.37	0.99	57.1	2.0
21	1–6	2.44	1.69	0.77	−0.83	47.8	6.3
24	1–6	1.30	0.86	3.60	13.75	83.4	1.0
26	1–6	2.85	2.08	0.56	−1.42	44.9	22.9
33	1–6	3.22	2.24	0.24	−1.77	42.4	34.1
36	1–6	1.64	1.26	2.18	3.93	71.2	2.9
45	1–6	1.94	1.59	1.48	0.77	67.3	6.3
46	1–6	3.12	1.84	0.38	−1.23	26.8	20.0
Need for parenthood							
1	1–6	2.46	1.68	0.85	−0.55	44.9	8.8
15	1–6	3.40	1.79	0.05	−1.29	22.9	19.0
20	1–6	2.81	1.75	0.59	−0.95	32.7	13.2
25	1–6	4.57	1.77	−0.85	−0.73	10.2	52.2
28	1–6	3.88	1.88	−0.22	−1.39	17.1	34.1
31	1–6	3.57	1.76	−0.06	−1.23	19.0	21.0
38	1–6	2.65	1.65	0.68	−0.75	35.1	8.8
41	1–6	3.96	1.72	−0.30	−1.14	12.7	28.8
Rejection of child-free lifestyle							
2	1–6	3.66	1.79	−0.17	−1.23	19.5	22.4
5	1–6	3.74	1.66	−0.18	−1.14	13.2	19.5
6	1–6	2.84	1.66	0.41	−1.07	31.7	8.3
8	1–6	2.10	1.50	1.21	0.37	55.1	5.4
10	1–6	2.93	1.86	0.48	−1.19	35.1	17.1
19	1–6	2.81	1.76	0.58	−1.01	33.7	12.7
23	1–6	3.93	1.50	−0.46	−0.64	9.8	15.6
29	1–6	3.77	1.76	−0.22	−1.20	16.6	24.9
34	1–6	4.19	1.80	−0.50	−1.15	12.2	38.5
42	1–6	4.09	1.75	−0.42	−1.17	11.2	31.7

SD: Standard Deviation

Table 2 Fit indices derived from the CFA for the FPI (*N*=205)

Model	χ^2 S-B	df	<i>p</i>	CFI	NNFI	RMSEA [95% CI]	SRMR	\DeltaCFI	\DeltaRMSEA
Model 1 – Original model	268.01	85	<0.001	0.87	0.83	0.103 [0.089, 0.116]	0.130	--	--
Model 2 – Alternative model	152.84	83	<0.001	0.95	0.94	0.064 [0.048, 0.080]	0.073	0.08	0.039

X² SB = Satorra-Bentler Scaled X² test; df = degrees of freedom; *p* = *p*-value; CFI = Comparative Fit Index; NNFI = Non-Normalized Fit Index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardized Root Mean Square Residual

Table 3 Correlations between FPI and HADS (*N*=205)

Variables	1	2	3	4	5	6	7	8	9
FPI									
1. Impact of infertility on life domains	--								
2. Social concern	0.774**	--							
3. Sexual concern	0.870**	0.507**	--						
4. Relationship concern	0.736**	0.368**	0.473**	--					
5. Representations about the importance of parenthood	0.265**	0.232**	0.219**	0.183**	--				
6. Rejection of child-free lifestyle	0.164*	0.170*	0.117	0.109	0.924**	--			
7. Need for parenthood	0.331**	0.259**	0.294**	0.233**	0.902**	0.669**	--		
8. Infertility global stress	0.807**	0.641**	0.685**	0.587**	0.783**	0.671**	0.766**	--	
Mental health									
9. HADS anxiety	0.525**	0.472**	0.417**	0.372**	0.017	-0.042	0.082	0.349**	--
10. HADS depression	0.489**	0.369**	0.396**	0.411**	-0.018	-0.073	0.048	0.304**	0.572**

p* < .005; *p* < .001; HADS: Hospital Anxiety and Depression Scale.

of child-free lifestyle and Need for parenthood). The values obtained for the item-test correlation were higher than 0.3 except for item 12 (Social concern; *r* = .092), item 33 (Relationship concern; *r* = -.064) and item 46 (Relationship concern; *r* = .081).

Discussion

This study aimed to translate and adapt the FPI into Spanish, as well as to obtain evidence of the reliability and validity of the FPI score interpretation in a sample of Spanish men and women who are diagnosed with infertility and undergoing ART. The FPI is widely used in infertility and mental health research, making it essential to have this instrument available for the Spanish population, as no previous studies have pursued this objective. Moreover, ample evidence supports the presence and impact of infertility and assisted reproductive technologies (ART) in this society. According to the latest official data published in the National Activity Registry - SEF Registry (Spanish Fertility Society, 2023a; 2023b), in Spain, 165,453 cycles of IVF and 33,818 cycles of AI were performed in 2021, indicating a progressive increase since records of this type have been kept. There has also been an increase in births through ART, totaling 40,638 babies, which represents a 33.3% increase compared to 2020 and accounts for 11% of total births in Spain. These figures highlight the relevance of this research topic and the importance of developing studies such as the one proposed in this work.

First, regarding the results obtained, it is shown that the fit indices of the factorial structure of the original model proposed by Newton et al. (1999) are inadequate. However, those obtained with the alternative model showed acceptable fit, suggesting the existence of a hierarchical structure composed of five first-order factors loading onto two second-order factors (the impact of infertility on life domains and the representations about the importance of parenthood in the lives of men and women), which, in turn, would load onto a third-order factor (global stress related to infertility). These findings align with those reported in other Southern European contexts, such as Portugal (Moura-Ramos et al., 2012) and Italy (Donarelli et al., 2015), which may reflect shared sociocultural values in these regions, such as strong pronatalist norms and the centrality of family. Unlike studies conducted in culturally distant settings (e.g., Peng et al., 2011, in China), the alternative model fits more coherently with the Spanish context. However, cross-cultural differences should be interpreted with caution, as factors such as sample characteristics (e.g., age, marital status, treatment stage), timing of data collection, and potential translation-related differences may also contribute to the discrepancies observed. Importantly, this model does not reject Newton et al.'s (1999) original framework but refines it, offering a hierarchical structure that integrates both situational stressors (e.g., social, sexual, relational concerns) and internalized beliefs about the role of parenthood.

Secondly, the results regarding the reliability of the FPI and its constituent factors, as measured by Cronbach's Alpha, ranged from 0.636 (Relationship concern) to 0.864

Table 4 Item-Test correlations and cronbach's alpha

Factors		Total sample ($N=142$)
Infertility global stress		0.891
Impact of infertility on life domains		0.851
Representations about the importance of parenthood		0.906
Items	Correlation item-test	α if item is deleted
Social concern ($\alpha=0.737$)		
9	0.448	0.708
12	0.092	0.761
14	0.341	0.724
27	0.372	0.720
30	0.476	0.703
35	0.413	0.714
39	0.545	0.693
40	0.631	0.682
43	0.320	0.728
44	0.393	0.718
Sexual concern ($\alpha=0.825$)		
3	0.587	0.799
4	0.357	0.829
7	0.329	0.835
13	0.552	0.804
17	0.611	0.795
22	0.690	0.785
32	0.563	0.802
37	0.716	0.779
Relationship concern ($\alpha=0.636$)		
11	0.449	0.576
16	0.471	0.578
18	0.540	0.572
21	0.376	0.595
24	0.315	0.619
26	0.302	0.614
33	-0.064	0.714
36	0.638	0.556
45	0.353	0.601
46	0.081	0.662
Rejection of child-free lifestyle ($\alpha=0.864$)		
1	0.525	0.857
15	0.705	0.836
20	0.578	0.851
25	0.440	0.866
28	0.690	0.838
31	0.709	0.836
38	0.581	0.851
41	0.677	0.840
Need for parenthood ($\alpha=0.864$)		
2	0.427	0.843
5	0.677	0.820
6	0.634	0.824
8	0.464	0.839
10	0.623	0.825
19	0.468	0.839
23	0.440	0.841
29	0.649	0.822
34	0.512	0.835
42	0.558	0.831

(Rejection of child-free lifestyle and Need for parenthood), indicating limited internal consistency for the Relationship Concern factor. It is noted that the internal consistency of the Relationship Concern factor would improve by removing item 33 (“I can’t imagine us ever separating because of this”) and the item 46 (“Talk about our fertility problem and my partner seems comforted”) achieving $\alpha=0.714$ and $\alpha=0.662$, respectively. A possible explanation for the deficits found in item 33 may relate to its literal meaning in Spanish. Specifically, “separating” refers to the end of a relationship when a legal marriage exists, which may not always be the case for the participants in the sample. Regarding item 46, the issue may stem from addressing two questions within the same statement. The first part assumes that the couple discusses the infertility problem, which may not be the reality. The second part refers to a feeling of comfort following discussions about infertility, and such conversations may not be common, limiting participants’ ability to endorse or reject the statement fully. It is possible that such conversations are not habitual for the couple, preventing them from fully affirming or denying the statement. A similar issue is observed with item 12 (“Family don’t seem to treat us any differently”), which is part of the social concern factor and shows a correlation with the item-total score below 0.30. This item assumes that participants’ families are aware of their infertility issues, which is often experienced with shame, rendering it a taboo subject (Gupta et al., 2024), leading to silence on the matter. Each of these reasons may explain the inconsistency of these items with others in the corresponding factor. A review of previous studies indicates that none specifically report deficiencies in these items, although it is not possible to know if such deficiencies exist, as they only provide Cronbach’s Alpha values for each factor without offering individual item performance data. For instance, Zurlo et al. (2017) eliminated items 12, 33, and 46 due to loading values below 0.30 identified in Exploratory Factor Patel et al. (2022) made a similar decision regarding item 33. In both studies, a reduced version of the FPI was proposed. Other results also show Cronbach’s Alpha values below 0.70 for the Relationship concern factor, such as in the study by Peng et al. (2011), which reported a value of 0.68 for women, and in Gourounti et al. (2011), where the original factor value was 0.65. In the latter study, the authors ultimately proposed merging the items from the Sexual concern and Relationship concern factors into a single factor (Spousal concern), achieving $\alpha=0.77$ in this case.

Regarding the evidence based on relations to other variables, the data from this study demonstrate the theoretically expected positive associations between global stress, the second-order factor “Impact of infertility on life domains,” and each of the first-order factors that comprise it (Social, Sexual, and Relationship concerns) with anxiety and

depression (assessed with the HADS). This indicates that higher levels of global stress related to infertility, particularly concerning key life domain concerns for these patients, correlate with greater levels of anxiety and depressive symptoms. Conversely, no correlations were observed between anxiety and depression with the second-order factor “Representations about the importance of parenthood” or its two constituent first-order factors (Rejection of child-free lifestyle and Need for parenthood). These results suggest that the mental health status in terms of anxiety and depression among participants is not related to their thoughts or beliefs about parenthood but rather to the direct impact of infertility on their daily lives, relationships, and social interactions. These findings are consistent with results from other FPI psychometric studies (Donarelli et al., 2015; Gourounti et al., 2011; Moura-Ramos et al., 2012; Newton et al., 1999; Patel et al., 2022; Peng et al., 2011; Zurlo et al., 2017). In the case of Moura-Ramos et al. (2012) and Donarelli et al. (2015), which are most similar to the findings of this study in terms of the defended theoretical model, correlations between depression and anxiety with the “Representations about the importance of parenthood” were observed. However, it is important to note that these measures were taken using different instruments (Brief Symptom Inventory and State-Trait Anxiety Inventory).

This study has several limitations that should be considered when interpreting the results. First, although the initial sample consisted of 532 individuals, only 205 patients completed the questionnaire, which may limit the generalizability of the findings. Patients undergoing ART constitute a hard-to-reach population, often experiencing shame and stigma that reduce willingness to participate in research. Given these difficulties, an online questionnaire was chosen to facilitate access, ensure anonymity, and allow for a standardized presentation of items. In this regard, the final sample size is comparable to that used in previous validation studies of the FPI (Gourounti et al., 2011; Moura-Ramos et al., 2012; Patel et al., 2022). Moreover, methodological research indicates that CFA sample size adequacy depends primarily on model characteristics—such as factor loadings, number of indicators, and overall model complexity—rather than on fixed numerical thresholds (Wolf et al., 2013). Given the performance of the model and the overall quality of the data, the use of 205 participants can be considered appropriate for the parcel-based CFA conducted in this study. Nevertheless, larger samples would enhance parameter stability and generalizability and should be pursued in future research. Second, measurement invariance across gender was not examined due to the unequal distribution of men and women in the sample. Future studies should include sufficiently balanced gender groups to assess whether the Spanish FPI functions equivalently across

gender. Third, same-sex couples and single women were excluded from the present study for several reasons, including the fact that, in these cases, being patients of ART does not imply a diagnosis of infertility, which sets them apart from the studied group. The small number of such participants also contributed to this decision, as the FPI measures dimensions related to romantic relationships, which do not apply to single women. Future research could aim for a sufficient sample of same-sex couples to explore the impact of ART on significant aspects of their lives, as well as investigate the stress generated by these procedures in single women across various domains. Fourth, item-level analyses indicated that three items (12, 33, and 46) showed low item–total correlations, suggesting potential comprehension or relevance issues within the Spanish cultural context. In particular, Item 46 contains a double-barreled formulation that was not identified during the cognitive debriefing phase, which constitutes a procedural limitation of the adaptation process. Although these issues did not substantially affect the overall performance of the scale, future studies should re-examine these items and consider their revision or removal based on evidence from larger samples. Finally, the confirmatory factor analyses relied on a parcel-based approach due to sample size constraints and the complexity of the hierarchical FPI structure. While parceling allowed for the estimation of theoretically motivated models with greater parameter stability, this strategy may obscure item-level multidimensionality and artificially improve model fit indices. Consequently, the present findings should be interpreted as an initial test of the Spanish FPI structure. Future research with larger samples should re-evaluate the factor structure using item-level models and more flexible SEM frameworks.

In conclusion, this research successfully translated, adapted, and validated the FPI in a Spanish sample of patients with infertility undergoing ART, demonstrating that interpretations of the FPI scores presented good levels of reliability and validity across most dimensions. The findings provide robust empirical support for the use of the FPI in Spanish-speaking populations, particularly within the socio-cultural context of Spain. The proposed alternative hierarchical model not only showed a superior fit compared to the original structure but also proved to be especially appropriate for capturing the specific ways in which infertility-related stress is experienced by Spanish patients. From a scientific perspective, this type of analysis enables researchers and clinicians to better identify areas for intervention and support for affected individuals, as it reveals connections between different dimensions of the issue, emphasizing that emotional distress cannot be adequately addressed without considering both social impacts and beliefs about parenthood.

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Author contributions S.D.-S., C.R.-D., and M.M.-R. reviewed the literature and proposed the study protocol (conceptualization). A.A.-S. and R.O.-S. were responsible for participant recruitment and organizing data collection. S.D.-S., M.M.-R., and I.G.-G. cleaned the database and conducted the statistical analyses. All authors contributed to the drafting of the manuscript (original and review). A.A.-S. and C.R.-D. supervised the research.

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Data availability Data and research materials are available upon request from the corresponding author.

Declarations

Informed consent/patient consent To participate in this study, participants had to accept informed consent. This consent was obtained on two occasions, when the participant was invited to the study and when accessing the online questionnaire.

Competing interests The authors have no competing interests to declare that are relevant to the content of this article.

Ethical statement This study was approved by the Sevilla Sur Healthcare Ethics Committee (no. 2651-N-20), on March 23, 2021.

Attestation statement Data regarding any of the subjects in the study has not been previously published unless specified. Data will be made available to the editors of the journal for review or query upon request.

Trial registration number/date Not applicable (this study is not a trial).

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