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ORIGINAL ARTICLE

Psychometric examination of the Multidimensional Psychological Flexibility Inventory Short Form (MPFI-24) and the Psy-Flex Spanish versions in individuals with chronic pain

Jaime Navarrete[1,2] | **Carla Rodríguez-Freire**[1] | **Juan P. Sanabria-Mazo**[1,2,3] | **David Martínez-Rubio**[4,5] | **Lance M. McCracken**[6] | **Ana Gallego**[7,8] | **Felicia T. A. Sundstrom**[6] | **Mayte Serrat**[9] | **Jordi Alonso**[2,10,11] | **Albert Feliu-Soler**[2,12] | **Rubén Nieto**[13] | **Juan V. Luciano**[1,2,12]

[1]Teaching, Research & Innovation Unit, Parc Sanitari Sant Joan De Déu, Sant Boi De Llobregat, Spain

[2]CIBER of Epidemiology and Public Health (CIBERESP), Madrid, Spain

[3]Department of Basic, Developmental and Educational Psychology, Faculty of Psychology, Autonomous University of Barcelona, Bellaterra, Spain

[4]Faculty of Health Sciences, Department of Psychology, Universidad Europea de Valencia, Valencia, Spain

[5]Department of Nursing and Physiotherapy, University of Lleida, Lleida, Spain

[6]Department of Psychology, Uppsala University, Uppsala, Sweden

[7]Department of Psychology, Faculty of Education and Psychology, University of Jyväskylä, Jyväskylä, Finland

[8]School of Wellbeing, JYU.Well, University of Jyväskylä, Jyväskylä, Finland

[9]Unitat d'Expertesa en Síndromes de Sensibilització Central, Servei de Reumatologia, Vall d'Hebron Hospital, Barcelona, Spain

[10]Health Services Research Unit, Hospital del Mar Research Institute Barcelona (IMIM), Barcelona, Spain

[11]Department of Medicine and Life Sciences, Universitat Pompeu Fabra, Barcelona, Spain

[12]Department of Clinical and Health Psychology, Faculty of Psychology, Autonomous University of Barcelona, Bellaterra, Spain

[13]eHealth Lab Research Group, Faculty of Health Sciences, Universitat Oberta de Catalunya, Barcelona, Spain

Correspondence
Juan V. Luciano, Department of Clinical and Health Psychology, Universitat Autònoma de Barcelona, Carrer de la Fortuna s/n, Bellaterra (Cerdanyola del Vallés) 08193, Spain.
Email: juanvicente.luciano@uab.cat

Jaime Navarrete, Teaching, Research and Innovation Unit, Parc Sanitari Sant Joan de Déu, Camí Vell de la Colònia,

Abstract

Background: Acceptance and Commitment Therapy (ACT) has been found to be beneficial for individuals dealing with chronic pain. The theoretical mechanisms of change proposed by ACT are based on the Hexaflex model. To comprehensively reflect this model, the Multidimensional Psychological Flexibility Inventory (MPFI) and Psy-Flex have been developed. The study aimed to adapt the MPFI-24 and the Psy-Flex for Spanish-speaking populations with chronic

Jaime Navarrete, Carla Rodríguez-Freire and Juan P. Sanabria-Mazo joint first co-authorship.

Albert Feliu-Soler, Rubén Nieto and Juan V. Luciano joint senior co-authorship.

25, St. Boi de Llobregat 08830, Spain.
Email: jaime.navarrete@sjd.es

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pain and to examine their dimensionality, internal consistency, convergent validity and incremental validity.

Methods: This cross-sectional study involved 309 Spanish-speaking adults with chronic pain who completed an online survey. The majority of the participants were women (88.3%). The ages ranged from 18 to 79 years.

Results: Factor analysis showed that the Spanish version of the MPFI-24 has 12 factors, consisting of six flexibility and six inflexibility factors, similar to the original version, but lacking second-order general factors. The Psy-Flex demonstrated a single-factor structure, maintaining the general factor of psychological flexibility seen in the original version. The MPFI-24 showed good internal consistency and adequate convergent validity, with the exception of the Acceptance and Experiential Avoidance subscales. The Psy-Flex showed good internal consistency and convergent validity. Notably, both the MPFI-24 and Psy-Flex scores significantly explained additional variance in psychological distress beyond other ACT-related measures of Hexaflex processes; however, only the Psy-Flex explained pain interference.

Conclusions: The Spanish adaptations of the MPFI-24 and Psy-Flex are valid and reliable instruments for assessing the Hexaflex model processes in Spanish-speaking adults with chronic pain.

Significance Statement: Practitioners and researchers in chronic pain will find the Spanish versions of the MPFI-24 and the Psy-Flex here, along with recommendations for their use and scoring based on a robust psychometric rationale. It should be noted that these measures surpass the Chronic Pain Acceptance Questionnaire (CPAQ) and the Psychological Inflexibility in Pain Scale (PIPS), which are considered gold standards in chronic pain assessment.

1 | INTRODUCTION

Chronic pain is persistent or recurrent pain lasting longer than 3 months (Treede et al., 2015) with an estimated prevalence of approximately 20% (Breivik et al., 2006; Sá et al., 2019; Yong et al., 2022). Chronic pain cannot be successfully treated biomedically, in most cases. However, it can be managed in the long term. Psychological approaches can play an important role in reducing the impacts of chronic pain on well-being and daily functioning. Among psychological therapies, Acceptance and Commitment Therapy (ACT), a form of CBT, is accumulating evidence and is increasingly implemented in this context (Hayes et al., 2006; Hughes et al., 2017; Lai et al., 2023).

The main objective of ACT is to lessen the impact of pain and associated restrictive experiences in daily life by enhancing psychological flexibility (PF) and reducing psychological inflexibility (PI) (Feliu-Soler et al., 2018). The therapeutic framework underlying ACT is termed the Hexaflex model, aptly named for its incorporation of six core processes that foster PF and six corresponding processes that constitute PI (Hayes et al., 2011). These PF/PI processes are: (a) acceptance/experiential avoidance, (b) defusion/fusion, (c) present moment awareness/lack of contact with the present moment, (d) self-as-context/self-as-content, (e) values clarity/lack of contact with values and (f) committed action/ inaction.

Over the past 15 years, researchers have developed multiple self-report measures of PF and PI (Cherry et al., 2021). However, most of these measures have focused on specific processes of the Hexaflex model such as values and committed action (e.g. Engaged Living Scale; Navarrete et al., 2023; Trompetter et al., 2013) or collapsed them into a single heterogeneous dimension (e.g. the Acceptance and Action Questionnaire; Bond et al., 2011; Hayes et al., 2004). Consequently, researchers aiming to assess all 12 dimensions of the model comprehensively have needed to combine several scales, encompassing too many items to be feasible (Rolffs et al., 2018). In response to this problem, several research groups have developed new measures to

comprehensively reflect the processes of the Hexaflex model while minimizing the number of items used. These efforts resulted in the Multidimensional Psychological Flexibility Inventory (MPFI, Rolffs et al., 2018), its short form (MPFI-24; Grégoire et al., 2020) and the Psy-Flex (Gloster et al., 2021).

The MPFI includes 60 items assessing both PF and PI (Rolffs et al., 2018). This inventory is structured hierarchically, featuring 12 first-order factors (six for PF and six for PI) loading onto two higher order factors. Rolffs et al. (2018) also suggested a short version of the MPFI, the MPFI-24, which includes the two most informative items from each process. In turn, the Psy-Flex is a 6-item scale that assesses PF (Gloster et al., 2021) based on a one-factor structure. Each item reflecting one of the six PF processes in the Hexaflex model yielding a global score for PF.

For populations with chronic pain, two prevalent ACT-related tools are employed to capture certain Hexaflex processes (Feliu-Soler et al., 2018). These tools are the Chronic Pain Acceptance Questionnaire (CPAQ; McCracken et al., 2004) and the Psychological Inflexibility in Pain Scale (PIPS; Wicksell et al., 2008). The CPAQ, a 20-item questionnaire, evaluates two aspects of pain acceptance: activity engagement and pain willingness. It has robust psychometric properties, as evidenced by a systematic review of acceptance questionnaires for pain management (Reneman et al., 2010). The PIPS, a 12-item scale, measures experiential avoidance and cognitive fusion. Together, these instruments assess three of the 12 aspects included in the Hexaflex model.

Key for improving the health and functioning of individuals with chronic pain is an in-depth understanding of the underlying mechanisms, including those that contribute to pain chronicity, its impact and therapeutic advances (McCracken et al., 2022). Indeed, elucidating the mechanisms underlying psychological interventions is of both theoretical and practical importance. Theoretical insights enhance the understanding of treatment processes, while practical applications promote the improvement and refinement of these interventions (McCracken et al., 2022). Comprehensive data capturing various facets of PF and PI would greatly facilitate this endeavour. Such data would enable researchers to pinpoint the processes most relevant to specific outcomes, individuals and contexts. Research on ACT in chronic pain is currently limited, as most studies have focused on a narrow range of processes within the Hexaflex model. This limitation is partly because measures that capture all facets of the model, such as the MPFI or Psy-Flex were not available or validated for the chronic pain population until recently. There is only one study on MPFI validation for chronic pain (Sundström et al., 2023), and this is a study of a Swedish-language version. Further validation studies of Hexaflex measures in individuals with chronic pain conditions, and in additional languages, are necessary. It would also be beneficial if shorter versions of these measures could be validated, offering the advantage of quicker administration in clinical and research contexts where time constraints are a concern.

The purpose of this study was to examine the psychometric properties of the Spanish versions of the MPFI-24 and Psy-Flex in a sample of Spanish individuals with chronic pain. Specifically, this research aimed to: (1) test the goodness-of-fit of previous factor models for the MPFI-24 and Psy-Flex; (2) determine the internal consistency of both instruments in a sample with pain for the first time; (3) examine their convergent validity using established measures of the Hexaflex and clinical outcomes; and (4) investigate their incremental validity relative to earlier generation Hexaflex measures in predicting psychological distress and pain interference. We hypothesized that the best fit for the MPFI-24 would be achieved by a 12-factor structure, comprising two items each, loading onto two higher order latent factors would yield the best fit (Hypothesis 1a). For Psy-Flex, it was further expected that a one-factor model containing, six items in total, would yield the best fit (Hypothesis 1b). We also expected that both instruments would demonstrate satisfactory internal consistency (Hypotheses 2a and 2b). Regarding convergent validity, it was hypothesized that the MPFI-24-PF and Psy-Flex scales would be positively associated with chronic pain acceptance and negatively associated with PI, pain severity, pain catastrophizing, pain-related fear and anxiety and depression symptoms (Hypotheses 3a and 3b). An inverse correlation pattern was expected for the MPFI-24-PI scores (Hypothesis 3a). Lastly, it was anticipated that the MPFI-24 and Psy-Flex would explain an additional and significant proportion of the variance in psychological distress and pain interference beyond that explained by the CPAQ and PIPS (Hypotheses 4a and 4b).

2 | METHODS

2.1 | Participants

The inclusion criteria included: (1) age 18 years or older, (2) native Spanish-speaking, and (3) experiencing persistent pain for more than 3 months. The exclusion criteria comprised: (1) pain duration of less than 3 months, and (2) incomplete survey responses. A total of 488 individuals initially consented to participate in the online survey. Of these, 179 were excluded for not completing all the

survey measures. Ultimately, 309 native Spanish speakers who reported chronic pain (lasting 3 months or longer) completed all required measures and constituted the final sample.

2.2 | Procedure

This study received approval from the Ethics Committee of the Open University of Catalonia and complied with the Declaration of Helsinki. The instruments used, MPFI-24 and Psy-Flex, were sourced from their respective original validation studies (MPFI-24: Rolffs et al., 2018; Psy-Flex: Gloster et al., 2021) at no cost. Three Spanish psychologists, who are proficient in English, independently translated the MPFI-24 and Psy-Flex from the original English into Spanish. They resolved minor discrepancies through discussion, achieving a unified version of each instrument by consensus. The consolidated Spanish versions were then back-translated into English by an independent native English-speaking professional. The back-translated versions displayed no significant deviations from the original English texts. Data collection occurred from February 2022 to February 2023 using a web-based platform (www.qualtrics.com). The survey link, which included all measures, was disseminated through appropriate channels, including social media platforms (notably, Facebook groups targeting individuals with various pain issues), and patient associations, especially those prominent within the Spanish chronic pain community.

2.3 | Instruments

2.3.1 | Sociodemographic characteristics

We collected data on sex, age range, marital status, educational level, employment status and type of chronic pain according to ICD-11 (Treede et al., 2019).

2.3.2 | Multidimensional Psychological Flexibility Inventory Short Form (MPFI-24; Rolffs et al., 2018)

The MPFI-24, a 24-item self-report measure, assesses PF and PI based on the Hexaflex model. Respondents rate items on a 6-point scale ranging from 1 ('never true') to 6 ('always true'). Twelve scores can be calculated, each based on two items, encompassing the 12 dimensions of the Hexaflex model, and two general scores of PF and PI (Grégoire et al., 2020). Higher scores indicate greater levels of psychological flexibility or inflexibility according to each subscale. The final version of the Spanish MPFI-24 can be found in the Supplemental Materials (Table S1).

2.3.3 | Psy-Flex (Gloster et al., 2021)

The Psy-Flex is a 6-item self-report measure that assesses PF according to the Hexaflex model. Each item is rated on a 5-point numerical rating scale ranging from 1 ('very seldom') to 5 ('very often'). A total score can be calculated by adding all items, with higher scores indicating greater PF. The final Spanish version of the Psy-Flex appears in the Supplemental Materials (Table S2).

2.3.4 | Chronic Pain Acceptance Questionnaire (CPAQ; McCracken et al., 2004)

The CPAQ, a 20-item self-report measure, assesses acceptance among individuals with chronic pain. Items are rated on a 7-point scale ranging from 0 ('never true') to 6 ('always true') and include two subscales: activity engagement (11 items) and pain willingness (9 items). A total score is calculated by summing the reverse-keyed items of pain willingness and the activity engagement items, with higher scores indicating higher levels of pain acceptance. The validated Spanish version was used (Rodero et al., 2010), showing good internal consistency in this study, indicated by a Cronbach's α value of 0.86.

2.3.5 | Psychological Inflexibility in Pain Scale (PIPS; Wicksell et al., 2008)

The PIPS, a 12-item self-report measure, assesses PI in individuals with pain. Each item is rated on a 7-point scale ranging from 1 ('never true') to 7 ('always true'), and the total score is calculated by summing all items. Higher scores indicate greater PI. In this study, we used the validated Spanish version (Rodero et al., 2013), which demonstrated excellent internal consistency, as indicated by a Cronbach's α value of 0.92.

2.3.6 | Brief Pain Inventory Short Form (BPI-SF; Cleeland & Ryan, 1994)

The BPI-SF, a 9-item self-report measure, evaluates pain severity and its impact on daily functions. It includes questions about pain severity, its impact on daily life, pain location, medications and relief over the past 24 h or week. Only the pain interference subscale, typically

scored by averaging the seven interference items, was used. Higher scores indicate greater interference. The Spanish validated version was used (de Andrés Ares et al., 2015). In this study, the score showed good internal consistency, indicated by a Cronbach's α value of 0.89.

2.3.7 | Pain Catastrophizing Scale (PCS; Sullivan et al., 1995)

The PCS is a 13-item self-report measure designed to assess pain catastrophizing in both clinical and non-clinical populations. Items are rated on a 5-point scale from 0 ('not at all') to 4 ('all the time'), and contains three subscales: rumination, magnification and helplessness. A global catastrophizing score can be obtained, which was used in this study. Higher global catastrophizing scores indicate higher levels of pain catastrophizing. The Spanish validated version was used (García-Campayo et al., 2008). In this study, it showed excellent internal consistency, indicated by a Cronbach's α value of 0.95.

2.3.8 | Tampa Scale for Kinesiophobia (TSK; Kori et al., 1990)

The TSK is an 11-item self-report measure evaluating fears of pain-related movement. Items are rated on a 4-point scale ranging from 1 ('strongly disagree') to 4 ('strongly agree'). The total score is calculated by summing all items, with higher scores indicating greater fear of pain-related movement. The Spanish validated version was used (Gómez-Pérez et al., 2011). In this study, TSK showed good internal consistency, indicated by a Cronbach's α value of 0.81.

2.3.9 | Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983)

The HADS is a 14-item self-report screening measure designed to assess symptoms of anxiety and depression. Items are rated on a 4-point scale ranging from 0 to 3. It consists of a 7-item anxiety subscale (e.g. 'Worrying thoughts go through my mind') and a 7-item depression subscale (e.g. 'I feel as if I am slowed down'). A total score can be calculated, with higher scores indicating more severe anxiety and depression symptoms or greater psychological distress. The Spanish version was used (Herrero et al., 2003). In this study, the HADS showed excellent internal consistency, indicated by Cronbach's α values of 0.91 for the total scale, and 0.87 and 0.90 for the two subscales, respectively.

2.4 | Data analysis

Data analysis was performed using SPSS v29 and Mplus v7.4. All variables were descriptively analysed (mean, standard deviation, range, skewness, kurtosis, frequency and percentages). Additionally, we computed Cronbach's α for all scales to assess internal consistency. According to DeVellis (1991), alpha coefficient of 0.70 or higher indicate adequate internal consistency.

The factor structures of the Spanish versions of the MPFI-24 and Psy-Flex were assessed first. Confirmatory factor analyses (CFAs) with a diagonally weighted least squares (WLSMV) estimation method were conducted to assess dimensionality. The models proposed by Grégoire et al. (2020) for the MPFI-24 were retested: all 24 items forming a single latent factor (Figure 1a), two 12-item correlated factors (Figure 1b), twelve 2-item first-order correlated factors (Figure 1c), twelve 2-item factors forming one higher order latent factor (Figure 1d) and twelve 2-item factors forming two higher order latent factors (Figure 1e). For the latter two models, we applied a bifactor approach to obtain a more nuanced representation of the unidimensionality of the general factors (Figure 1f,g). For the Psy-Flex, we utilized the one-factor model with all six items forming a single latent factor, replicating the structured used by Gloster et al. (2021). This model was calculated both with and without the correlated residuals between items 5 and 6 as suggested by Gloster et al. (2021) in their psychometric study. Post hoc exploratory structural equation modelling (ESEM) was used to analyse the factor structure of the MPFI-24 since CFA analyses indicated a poor model fit for all models. ESEM holds a less strong assumption about cross-loadings than does CFA. It allows items to load on non-target factors, though targeting them to be as close to zero as possible. The goal of this approach was to investigate cross-loading and residual covariance parameters to generate ideas about possible model modifications (Asparouhov et al., 2015; Morin et al., 2020).

To assess model-data fit, we utilized four fit indices as suggested by Hu and Bentler (1999): the comparative fit index (CFI), the Tucker–Lewis index (TLI), the root-mean-square error of approximation (RMSEA) with a 90% confidence interval, and the weighted root-mean-square residual (WRMR). Each index provides a unique perspective on the fit of the tested models to the data. The following cut-off points for acceptable fit were used (Hu & Bentler, 1999; Schermelleh-Engel et al., 2003): the CFI and TLI should be close to or >0.90 or 0.95, RMSEA should be close to or <0.06 or 0.10, and WRMR should be close to or less than 1.

In addition to Cronbach's α, McDonald's ω was used to investigate the internal consistency of the MPFI-24 and

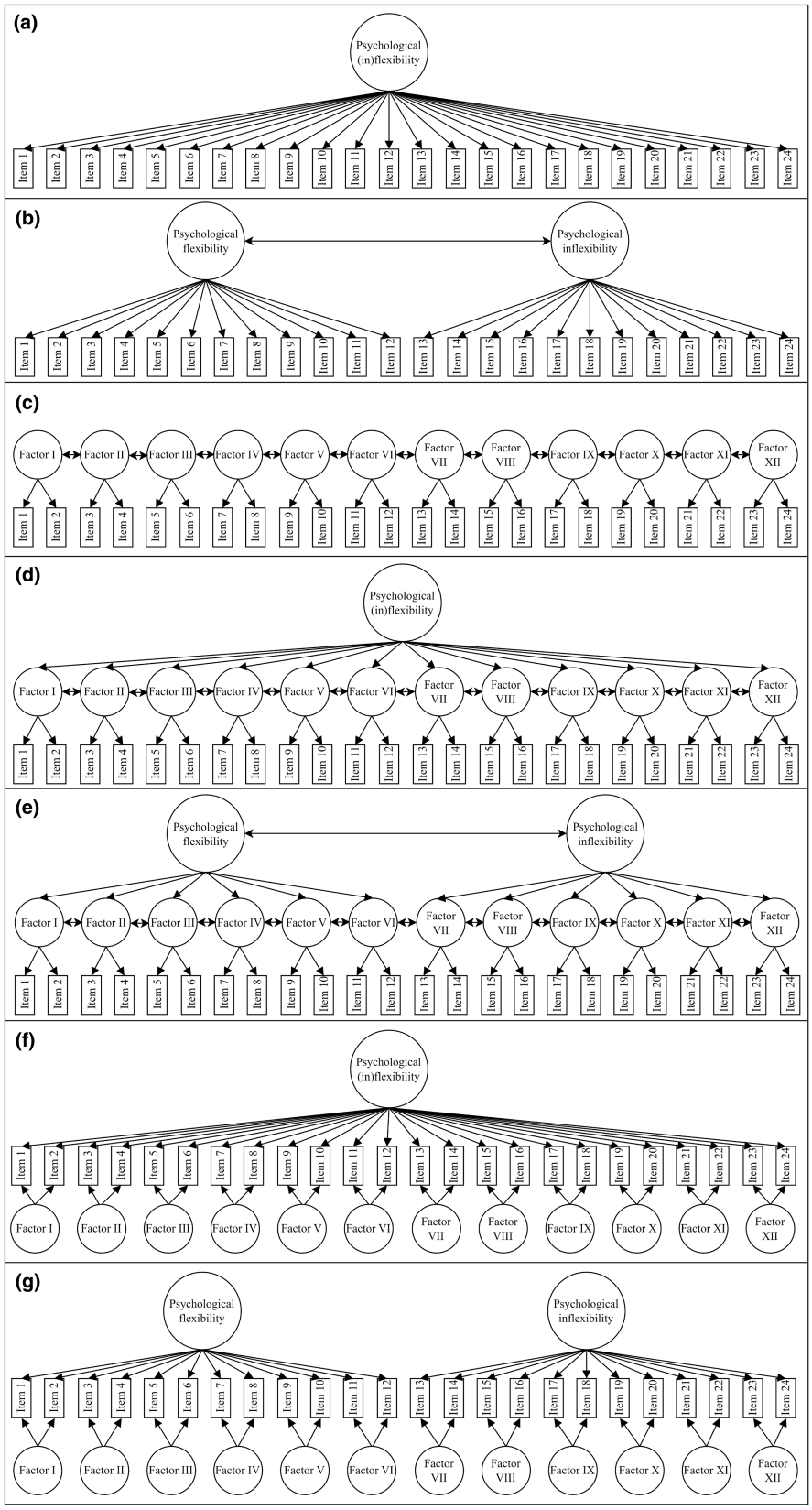

FIGURE 1 Factorial models of the Spanish MPFI-24. (a) all 24 items forming a single latent factor, (b) two 12-item correlated factors, (c) twelve 2-item first-order correlated factors, (d) twelve 2-item factors forming one higher order latent factor, (e) twelve 2-item factors forming two higher order latent factors, (f) bifactor model with one general factor plus twelve specific factors, and (g) bifactor model with two general factors plus twelve specific factors. Factor I, acceptance; Factor II, present moment awareness; Factor III, self as context; Factor IV, defusion; Factor V, values; Factor VI, committed action; Factor VII, experiential avoidance; Factor VIII, lack of contact with the present moment; Factor IX, self as content; Factor X, fusion; Factor XI, lack of contact with values; Factor XII, inaction. In models c–e, Factors I–XII are correlated among them.

Psy-Flex. Moreover, we computed psychometric indices derived from the standardized loading matrix of the bifactor models, where applicable (Rodriguez et al., 2016). These indices, including omega reliability coefficients, are reported in the Supplementary Material (see Table S3). Corrected item-total correlations (r_tot) for the MPFI-24 and Psy-Flex items were calculated, when applicable, to examine the homogeneity of each scale. A coefficient lower than 0.30

indicates that an item might measure a construct divergent from the scale's core dimensions (DeVellis, 1991).

Convergent validity was estimated by calculating Pearson correlation coefficients between the MPFI-24, Psy-Flex, CPAQ (chronic pain acceptance), PIPS (psychological inflexibility in pain), BPI-SF (pain interference), PCS (pain catastrophizing), TSK (pain-related fear), HADS-A (anxiety), HADS-D (depression) and HADS-T (general distress). We ensured normal distribution of scores on each variable by examining descriptive statistics, including skewness and kurtosis, and reviewing histograms. The strength of the correlations was interpreted following Cohen's (1988) guidelines: small (r = 0.10–0.29), medium (r = 0.30–0.49) and large (r = 0.50–1.00). Pearson's correlation coefficients among the MPFI-24 subscale scores were also computed (see Table S4).

Lastly, the incremental validity of the MPFI-24 and Psy-Flex scores compared to the CPAQ and PIPS in relation to general distress and pain interference was investigated. For this purpose, four hierarchical multiple regressions were computed controlling for gender, age, marital status, level of education and employment status. All sociodemographic variables were recoded as dummy variables as follows: 'gender' (0 = female, 1 = male), 'age' (each year group recoded as dummy variable; 0 = no, 1 = yes), 'marital status' (each category recoded as dummy variable; 0 = no, 1 = yes), 'level of education' (each category recoded as dummy variable; 0 = no, 1 = yes) and 'employment' (categories simplified as 0 = no active employment, 1 = person in active employment). In each regression, categorical variables were entered first (Step 1), followed by CPAQ and PIPS scores (Step 2) and then MPFI-24 and Psy-Flex scores (Step 3). We conducted preliminary analyses to confirm the assumptions of multicollinearity, outliers, normality, linearity and homoscedasticity with no significant violations detected. We assessed the unique contribution of each variable using Beta (β) coefficients and semi-partial correlation (sr) (Tabachnick & Fidell, 2013). Additionally, the change in the coefficient of determination (ΔR2) from Steps 2 to 3 was evaluated to estimate how much additional variance in the HADS total scores and the BPI-interference scores total scores was explained by the MPFI-24 and Psy-Flex scores, beyond that accounted for by the CPAQ and PIPS scores.

3 | RESULTS

3.1 | Sample characteristics

The sociodemographic and clinical characteristics of the participants are presented in Table 1. The sample comprised 309 Spanish adults, of which 88.3% were women. The ages ranged from 18 to 79 years. All participants reported experiencing chronic pain, defined as pain lasting more than 3 months. Most of the participants (88.7%) reported that their pain was of a musculoskeletal origin.

TABLE 1 Sociodemographic data of the study participants ($n = 309$).

Sex (women): *n* (%)	273 (88.3)
Age (years): *n* (%)	
18–29	33 (10.7)
30–39	60 (19.4)
40–49	100 (32.4)
50–59	86 (27.8)
60–69	29 (9.4)
70–79	1 (0.3)
Marital status: *n* (%)	
Single	124 (40.1)
Married or in a formal relationship	152 (49.2)
Separated/divorced	32 (10.4)
Widowed	1 (0.3)
Level of education: *n* (%)	
Primary school	22 (7.1)
Secondary school	123 (39.8)
University	164 (53.1)
Work status: *n* (%)	
Student	15 (4.9)
Homemaker	15 (15.9)
Self-employed	18 (5.8)
Employed (worker)	67 (21.7)
Employed (public official)	29 (9.4)
On a sick leave	57 (18.4)
Unemployed (with sickness allowance)	13 (4.2)
Unemployed (without sickness allowance)	31 (10)
Unable to work (permanent disability)	57 (18.4)
Retired/pensioner	7 (2.3)
Chronic pain type[a]: *n* (%)	
Primary pain syndrome (e.g. fibromyalgia)	188 (60.8)
Cancer-related pain	13 (4.2)
Post-surgical or post-traumatic pain	56 (18.1)
Neuropathic pain	89 (28.8)
Secondary headache or orofacial pain	69 (22.3)
Secondary visceral pain	58 (18.8)
Musculoskeletal pain	274 (88.7)

Note: *n* = frequencies. % = percentages.

[a]More than one option could be selected. The key difference between worker and employed public official lies in the nature of the employer–private sector for the former and public sector for the latter. Unlike being unemployed with sick allowance, permanent disability implies a long-term or permanent inability to work, often requiring long lasting support or assistance.

TABLE 2 Descriptive statistics of the MPFI-24 and standardized factor loadings for the twelve 2-item correlated ESEM model ($n = 309$).

				λ											
	M **(SD)**	***S***	***K***	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**
Flexibility subscales															
Factor I. Acceptance ($\alpha = 0.34$; $\omega = 0.52$)															
1. I was receptive to observing unpleasant thoughts and feelings without interfering with them	3.18 (1.29)	0.21	−0.56	**0.24**	0.26	−0.06	0.10	−0.06	−0.02	−0.23	0.17	−0.02	0.32	−0.18	0.16
2. I tried to make peace with my negative thoughts and feelings rather than resisting them	3.73 (1.24)	−0.24	−0.39	**0.94**	0.01	0.01	0.02	0.01	−0.01	0.01	−0.01	0.00	0.00	0.00	−0.01
Factor II. Present moment awareness ($\alpha = 0.63$; $\omega = 0.80$)															
3. I was attentive and aware of my emotions	4.06 (1.19)	−0.40	−0.26	0.03	**0.95**	0.00	−0.03	−0.01	0.03	0.00	−0.01	0.00	−0.02	0.01	0.00
4. I was in tune with my thoughts and feelings from moment to moment	3.06 (1.24)	0.45	−0.35	−0.08	**0.29**	0.29	0.26	0.16	−0.17	0.12	−0.06	−0.01	−0.02	−0.25	0.09
Factor III. Self as context ($\alpha = 0.83$; $\omega = 0.83$)															
5. Even when I felt hurt or upset, I tried to maintain a broader perspective	3.64 (1.23)	−0.07	−0.57	0.11	0.07	**0.60**	0.06	0.09	−0.01	0.06	0.02	−0.04	−0.06	−0.02	−0.09
6. I carried myself through tough moments by seeing my life from a larger viewpoint	3.78 (1.30)	−0.15	−0.58	−0.04	0.11	**0.47**	0.24	0.06	0.16	0.05	−0.06	−0.03	0.00	0.06	−0.02
Factor IV. Defusion ($\alpha = 0.92$; $\omega = 0.93$)															
7. I was able to let negative feelings come and go without getting caught up in them	3.53 (1.27)	0.15	−0.51	0.02	0.02	0.10	**0.80**	−0.03	0.05	0.01	−0.02	−0.03	0.01	0.00	−0.07
8. When I was upset, I was able to let those negative feelings pass through me without clinging to them	3.52 (1.27)	0.22	−0.65	0.07	−0.01	−0.02	**0.76**	0.08	0.03	0.04	−0.02	−0.04	−0.10	−0.01	0.03
Factor V. Values ($\alpha = 0.87$; $\omega = 0.88$)															

TABLE 2 (Continued)

	M (SD)	*S*	*K*	λ I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
9. I was very in-touch with what is important to me and my life	3.85 (1.29)	−0.11	−0.66	0.07	−0.04	0.00	0.19	**0.58**	0.16	−0.02	−0.02	0.08	−0.01	−0.18	0.04
10. I stuck to my deeper priorities in life	3.84 (1.32)	−0.12	−0.81	0.01	0.01	0.01	−0.01	**0.95**	0.02	0.01	−0.01	−0.02	0.00	0.01	−0.01
Factor VI. Committed action ($\alpha = 0.87$; $\omega = 0.86$)															
11. Even when I stumbled in my efforts, I did not quit working towards what is important	3.87 (1.31)	−0.18	−0.68	−0.03	0.04	0.00	0.05	0.01	**0.86**	0.01	−0.03	−0.02	0.04	−0.03	−0.04
12. Even when times got tough, I was still able to take steps towards what I value in life	4.06 (1.31)	−0.30	−0.53	0.05	−0.01	0.07	0.04	0.22	**0.59**	0.07	0.03	0.04	−0.08	0.05	−0.05
Inflexibility subscales															
Factor VII. Experiential avoidance ($\alpha = 0.89$; $\omega = 0.92$)															
13. When I had a bad memory, I tried to distract myself to make it go away	3.92 (1.21)	−0.18	−0.40	0.01	−0.01	0.00	0.01	−0.01	0.02	**0.98**	−0.01	−0.01	0.00	0.00	0.02
14. I tried to distract myself when I felt unpleasant emotions	3.89 (1.18)	−0.11	−0.53	−0.07	0.09	0.02	−0.04	0.11	−0.10	**0.86**	0.05	0.08	0.02	−0.02	−0.18
Factor VIII. Lack of contact with the present moment ($\alpha = 0.88$; $\omega = 0.90$)															
15. I did most things on 'automatic' with little awareness of what I was doing	3.35 (1.23)	0.15	−0.53	0.08	−0.07	0.06	−0.03	−0.12	0.11	0.06	**0.93**	−0.01	−0.06	−0.06	0.06
16. I did most things mindlessly without paying much attention	3.28 (1.25)	0.23	−0.65	−0.05	0.03	−0.03	0.02	0.07	−0.06	−0.03	**0.92**	0.01	0.03	0.04	−0.03
Factor IX. Self as content ($\alpha = 0.85$; $\omega = 0.86$)															
17. I thought some of my emotions were bad or inappropriate and I should not feel them	3.10 (1.38)	0.22	−0.81	−0.04	0.01	−0.16	0.09	0.02	−0.09	0.14	0.07	**0.64**	0.19	0.01	−0.02

(Continues)

TABLE 2 (Continued)

	M (SD)	*S*	*K*	λ I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
18. I criticized myself for having irrational or inappropriate emotions	3.19 (1.54)	0.13	−1.07	0.00	0.00	0.01	−0.01	−0.01	0.01	−0.01	0.00	**0.99**	−0.01	0.00	0.01
Factor X. Fusion ($\alpha = 0.89$; $\omega = 0.86$)															
19. Negative thoughts and feelings tended to stick with me for a long time	3.27 (1.37)	0.24	−0.75	0.02	−0.01	−0.10	0.05	0.04	−0.06	−0.03	0.01	0.06	**0.83**	0.06	0.00
20. Distressing thoughts tended to spin around in my mind like a broken record	3.52 (1.39)	−0.03	−0.86	0.00	−0.03	0.11	−0.14	−0.06	0.08	0.05	0.02	−0.03	**0.85**	−0.01	0.07
Factor XI. Lack of contact with values ($\alpha = 0.77$; $\omega = 0.77$)															
21. My priorities and values often fell by the wayside in my day to day life	3.05 (1.38)	0.30	−0.74	−0.11	0.06	−0.12	0.16	−0.08	−0.07	0.10	0.06	0.12	0.13	**0.54**	0.10
22. When life got hectic, I often lost touch with the things I value	3.41 (1.39)	0.06	−0.96	0.06	−0.06	0.12	−0.07	−0.03	0.03	−0.06	0.05	0.01	0.04	**0.70**	0.11
Factor XII. Inaction ($\alpha = 0.92$; $\omega = 0.92$)															
23. Negative feelings often trapped me in inaction	3.23 (1.46)	0.20	−0.89	0.01	−0.06	0.13	−0.05	0.03	−0.07	−0.08	0.00	0.12	0.14	0.07	**0.64**
24. Negative feelings easily stalled out my plans	3.10 (1.49)	0.32	−0.90	0.00	0.01	−0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	**0.98**

Note. Standardized factor loadings on latent factors (λ). Target factor loadings are in bold.

Abbreviations: *K*, kurtosis; *M*, mean; *S*, skewness; SD, standard deviation.

TABLE 3 Descriptive statistics of the Psy-Flex and standardized factor loadings for the one-factor model ($n = 309$).

Psy-Flex items	*M* (SD)	*S*	*K*	r_{tot}	λ
1. Even if I am somewhere else with my thoughts, I can focus on what is going on in important moments	3.56 (1.07)	−0.44	−0.50	0.69	0.73
2. If need be, I can let unpleasant thoughts and experiences happen without having to get rid of them immediately	3.11 (0.97)	−0.05	−0.41	0.53	0.58
3. I can look at hindering thoughts from a distance without letting them control me	3.18 (1.02)	0.01	−0.56	0.73	0.80
4. Even if thoughts and experiences are confusing me, I can notice something like a steady core inside of me	3.29 (1.11)	−0.12	−0.76	0.75	0.83
5. I determine what is important for me and decide what I want to use my energy for	3.68 (1.10)	−0.63	−0.24	0.69	0.74
6. I engage thoroughly in things that are important, useful or meaningful to me	3.80 (1.07)	−0.78	0.06	0.62	0.67

Note: Standardized factor loadings on the latent factor (λ) of the one-factor solution with the correlated residuals between Items 5 and 6. All parameters were significant ($p < 0.05$).

Abbreviations: *K*, kurtosis; *M*, mean; r_{tot}, corrected item-total correlation; *S*, skewness; SD, standard deviation.

3.2 | Item analysis

Table 2 shows the descriptive statistics of the MPFI-24 items and their standardized factor loadings for the best-fitting model. The skewness and kurtosis levels showed that the item scores of the MPFI-24 were normally distributed. Furthermore, an inspection of factor estimates showed that Items 1 and 4 of the MPFI-24 had high loadings on more than one process (see Table 2 for more details). Table 3 shows the descriptive statistics of the Psy-Flex items and their standardized factor loadings. The levels of skewness and kurtosis showed that the item scores were normally distributed. Notably, all items were highly loaded on the general factor (>0.58) (see Table 3 for more details).

3.3 | Dimensionality

Regarding the MPFI-24, CFA indicated poor fit for all tested models. The fit indices for these models are shown in Table S5. Furthermore, the twelve 2-item correlated factors model and the second-order models (both hierarchical and bifactor) showed Heywood cases and/or fail to converge (see Table S5 for more details). Post hoc ESEM analysis showed that the best-fitting models of the MPFI-24 were the twelve 2-item correlated factor models (CFI = 0.99; TLI = 0.99; RMSEA = 0.05 with CI 90% [0.03, 0.07]; WRMR = 0.14) and the twelve 2-item factors and one single general factor (bifactor) model (CFI = 0.99; TLI = 0.99; RMSEA = 0.05, CI 90% [0.03, 0.07]; WRMR = 0.12). See Table 4 for all ESEM goodness-of-fit indices of the MPFI-24 models. It should be noted that when the former was examined, a Heywood case appeared (as the relationship between the factor 'IX-Self as content' and Item 18 showed a standardized coefficient of 1.03); thus, the residual variance of Item 18 was fixed to 0 (which is in line with the recommendations of Dillon et al., 1987). Table 2 shows the standardized factor loadings for the twelve 2-item correlated ESEM model. Table S6 shows the standardized factor loadings for the twelve 2-item factors and a single general factor (bifactor) model. Regarding Psy-Flex, CFA showed that the one-factor solution with correlated residuals between Items 5 and 6 fitted the data better (CFI = 0.99; TLI = 0.99; RMSEA = 0.09, CI 90% [0.06, 0.13]; WRMR = 0.55) than the model without correlated residuals (CFI = 0.98; TLI = 0.96; RMSEA = 0.14, CI 90% [0.11, 0.18]; WRMR = 0.84).

3.4 | Internal consistency

The internal consistency of the MPFI-24 factors was adequate with Cronbach's α and McDonald's ω ranging

TABLE 4 ESEM goodness-of-fit indices of potential models for the MPFI-24.

	Model χ^2						
Examining factor structure	**Est.**	***df***	***p***	**CFI**	**TLI**	**WRMR**	**RMSEA [90% CI]**
All 24 items forming one single latent factor	3637.06	252	<0.001	0.786	0.765	4.092	0.208 [0.203, 0.215]
Two 12-item correlated factors	3208.84	229	<0.001	0.811	0.773	2.261	0.205 [0.199, 0.212]
Twelve 2-item correlated factors	94.52	54	<0.001	0.997	0.987	0.137	0.049 [0.032, 0.065]
Twelve 2-item factors forming one higher order latent factor[a]	863.95	108	<0.001	0.952	0.878	1.156	0.151 [0.141, 0.160]
Twelve 2-item factors & one single general factor (bifactor model)	74.71	42	<0.001	0.998	0.986	0.117	0.050 [0.031, 0.068]
Twelve 2-item factors forming two higher order latent factor[b]	670.79	107	<0.001	0.964	0.908	0.890	0.131 [0.121, 0.140]

Note: The chosen estimator was weighted least square mean and variance adjusted (WLSMV). Indices for twelve 2-item factors and two correlated general factors (bifactor model) is not shown because the Mplus model did not converge.

Abbreviations: 90% CI, 90% confidence interval of the RMSEA; CFI, Comparative Fit Index; RMSEA, root mean square error approximation; TLI, Tucker–Lewis Index; WRMR, weighted root mean square residual.

[a]This model showed Heywood cases involving items 2, 5, 11, 13, 15, 17, 20 and 24 with standardized factors loadings higher than 1 in their respective subfactors.

[b]This model showed Heywood cases involving items 2, 11, 13, 15, 20 and 24 with standardized factors loadings higher than 1 in their respective subfactors.

from 0.75 to 0.93, as shown in Table 2. However, Factor I-Acceptance, deviated from this trend, showing values lower than 0.70 ($\alpha = 0.34$, $\omega = 0.52$). Although Factor II-Present Moment Awareness showed an α under this cut-off point (0.63), its ω (0.80) indicated good internal consistency. The internal consistency of the Psy-Flex was good, with Cronbach's α and McDonald's ω equal to 0.87 (both). In addition, the r_tot of the Psy-Flex items was greater than 0.30 in all cases (ranging from 0.53 to 0.75), suggesting adequate homogeneity.

3.5 | Convergent validity

The relationships between the MPFI-24 subscales, Psy-Flex and the other measures are shown in Table 5. The MPFI-24 flexibility subscales Factor II-Present moment awareness, Factor III-Self as context, Factor IV-Defusion, Factor V-Values and Factor VI-Committed action were positively correlated with Psy-Flex (medium-to-large magnitude) and CPAQ (chronic pain acceptance; small-to-medium magnitude), and negatively correlated with PIPS (psychological inflexibility in pain; small-to-medium magnitude), BPI-interference (small magnitude), PCS (pain catastrophizing; medium magnitude), TSK (pain-related fear; small magnitude) and HADS scales (anxiety, depression, general distress; medium to large magnitude). Conversely, the MPFI-24 inflexibility subscales Factor VIII-Lack of contact with the present moment, Factor IX-Self as content, Factor X-Fusion, Factor XI-Lack of contact with values and Factor XII-Inaction were positively correlated with PIPS (medium-to-large magnitude), BPI-interference (small magnitude), PCS (medium-to-large magnitude), TSK (small magnitude) and HADS scales (medium-to-large magnitude) and negatively correlated with Psy-Flex (medium-to-large magnitude) and CPAQ (medium magnitude). Notably, Factor I-Acceptance from the MPFI-24 flexibility did not show significant correlation with any measured variable. Furthermore, Factor VII-Experiential Avoidance, as opposed to the rest of the inflexibility subscales, was positively correlated with Psy-Flex (medium magnitude) and CPAQ (small magnitude) and negatively correlated with PIPS (small magnitude), PCS (small magnitude), TSK (small magnitude) and HADS scales (medium magnitude). Finally, Psy-Flex scores were positively correlated with CPAQ scores (medium magnitude) and negatively correlated with PIPS (medium magnitude), BPI-interference (medium magnitude), PCS (medium magnitude), TSK (small magnitude) and HADS (large magnitude) scores.

3.6 | Incremental validity

Table 6 summarizes the results of the two hierarchical multiple regression analyses for the MPFI-24. Sociodemographic variables were entered in Step 1, explaining 10.9% of the variance in the HADS-T scores and 8.5% of the variance in BPI-interference scores. After entering the CPAQ and PIPS scores in Step 2, the total

TABLE 5 Convergent Validity of the MPFI-24 and Psy-Flex.

	Psy-flex	CPAQ	PIPS	BPI-SF	PCS	TSK	HADS-A	HADS-D	HADS-T
MPFI-24: Flexibility Subscales									
Factor I. Acceptance	0.09	−0.08	0.11	−0.02	0.08	0.10	0.05	0.08	0.07
Factor II. Present moment awareness	0.46***	0.25***	−0.26***	−0.21***	−0.30***	−0.21***	−0.38***	−0.37***	−0.42***
Factor III. Self as context	0.56***	0.40***	−0.37***	−0.25***	−0.43***	−0.28***	−0.47***	−0.51***	−0.55***
Factor IV. Defusion	0.63***	0.39***	−0.36***	−0.26***	−0.44***	−0.27***	−0.52***	−0.49***	−0.56***
Factor V. Values	0.57***	0.37***	−0.37***	−0.22***	−0.37***	−0.19**	−0.48***	−0.52***	−0.56***
Factor VI. Committed action	0.58***	0.44***	−0.38***	−0.24***	−0.40***	−0.24***	−0.41***	−0.53***	−0.53***
MPFI-24: Inflexibility Subscales									
Factor VII. Experiential avoidance	0.39***	0.17**	−0.16**	−0.07	−0.24***	−0.18**	−0.33***	−0.29***	−0.35***
Factor VIII. Lack of contact with the present moment	−0.41***	−0.31***	0.39***	0.16**	0.43***	0.25***	0.41***	0.41***	0.46***
Factor IX. Self as content	−0.48***	−0.37***	0.45***	0.18**	0.48***	0.33***	0.53***	0.43***	0.53***
Factor X. Fusion	−0.58***	−0.44***	0.54***	0.27***	0.60***	0.31***	0.64***	0.58***	0.68***
Factor XI. Lack of contact with values	−0.58***	−0.43***	0.54***	0.32***	0.52***	0.30***	0.52***	0.58***	0.61***
Factor XII. Inaction	−0.61***	−0.46***	0.61***	0.26***	0.57***	0.33***	0.62***	0.63***	0.70***
Psy-Flex									
General factor. Psychological flexibility	1	0.41***	−0.47***	−0.32***	−0.49***	−0.26***	−0.53***	−0.59***	−0.63***

Note: $n = 309$.

Abbreviations: BPI-SF, Brief Pain Inventory-Short Form; CPAQ, Chronic Pain Acceptance Questionnaire; HADS-A/-D/-T, Hospital Anxiety Depression Scale–Anxiety/Depression/Total Score for General Distress; PCS, Pain Catastrophizing Scale; PIPS, Psychological Inflexibility in Pain Scale; TSK, Tampa Scale for Kinesiophobia.

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

TABLE 6 Hierarchical multiple regression analysis predicting HADS and BPI-SF total scores with MPFI-24.

		95% CI for B						
Predictor variables	***B***	**LL**	**UL**	***β***	***p***	**sr**	R^2	ΔR^2
Dependent variable: HADS-T								
Constant	18.37	10.33	26.42		0.000		0.11	0.11
Gender	0.25	−1.53	2.03	0.01	0.785	0.01		
Age (30–39 years)	1.14	−1.11	3.38	0.05	0.321	0.03		
Age (40–49 years)	1.48	−0.71	3.68	0.08	0.185	0.04		
Age (50–59 years)	1.30	−0.98	3.58	0.07	0.262	0.04		
Age (60–69 years)	1.81	−1.03	4.66	0.06	0.211	0.04		
Age (70–79 years)	2.37	−8.29	13.02	0.02	0.663	0.02		
Married	0.60	−0.81	2.01	0.04	0.404	0.03		
Divorced	0.62	−1.56	2.80	0.02	0.574	0.02		
Widowed	−5.07	−15.01	4.86	−0.03	0.316	−0.03		
Secondary education	−1.39	−3.76	0.97	−0.08	0.247	−0.04		
University degree	−2.21	−4.56	0.14	−0.13	0.065	−0.06		
Working	−1.01	−2.25	0.24	−0.06	0.113	−0.05		
CPAQ	−0.07	−0.13	−0.02	−0.15	**0.014**	−0.08	0.41	0.30
PIPS	0.16	−0.77	1.09	0.02	0.741	0.01		
Factor I. Acceptance	0.85	0.16	1.54	0.10	**0.016**	0.08	0.68	0.27
Factor II. Present moment awareness	−0.41	−1.20	0.39	−0.05	0.318	−0.03		
Factor III. Self as context	−0.71	−1.55	0.13	−0.10	0.098	−0.06		
Factor IV. Defusion	−0.18	−1.01	0.65	−0.03	0.675	−0.01		
Factor V. Values	−0.95	−1.74	−0.15	−0.14	**0.020**	−0.08		
Factor VI. Committed action	−0.17	−0.93	0.58	−0.03	0.653	−0.02		
Factor VII. Experiential avoidance	−0.11	−0.76	0.53	−0.02	0.732	−0.01		
Factor VIII. Lack of contact with the present moment	0.61	0.02	1.20	0.09	**0.044**	0.07		
Factor IX. Self as content	−0.15	−0.76	0.46	−0.03	0.627	−0.02		
Factor X. Fusion	1.30	0.51	2.08	0.20	**0.001**	0.11		
Factor XI. Lack of contact with values	0.48	−0.20	1.17	0.07	0.165	0.05		
Factor XII. Inaction	1.20	0.49	1.92	0.20	**0.001**	0.11		
Dependent variable: BPI-SF								
Constant	6.14	3.38	8.91		0.000		0.09	0.09
Gender	−0.71	−1.32	−0.10	−0.12	**0.023**	−0.11		
Age (30–39 years)	0.61	−0.16	1.39	0.12	0.121	0.08		
Age (40–49 years)	0.34	−0.42	1.09	0.08	0.377	0.04		
Age (50–59 years)	0.39	−0.40	1.17	0.09	0.334	0.05		
Age (60–69 years)	−0.05	−1.03	0.93	−0.01	0.915	−0.01		
Age (70–79 years)	−0.67	−4.33	3.00	−0.02	0.720	−0.02		
Married	−0.14	−0.63	0.34	−0.04	0.567	−0.03		
Divorced	−0.08	−0.83	0.67	−0.01	0.841	−0.01		
Widowed	−0.47	−3.88	2.95	−0.01	0.788	−0.01		

TABLE 6 (Continued)

Predictor variables	*B*	95% CI for B LL	UL	*β*	*p*	sr	R^2	ΔR^2
Secondary education	0.01	−0.81	0.82	0.00	0.990	0.00		
University degree	−0.30	−1.11	0.51	−0.08	0.472	−0.04		
Working	−0.18	−0.61	0.25	−0.04	0.416	−0.04		
CPAQ	−0.02	−0.04	0.00	−0.18	**0.044**	−0.10	0.28	0.19
PIPS	0.49	0.17	0.81	0.29	**0.003**	0.15		
Factor I. Acceptance	−0.02	−0.26	0.22	−0.01	0.860	−0.01	0.31	0.03
Factor II. Present moment awareness	−0.13	−0.41	0.14	−0.07	0.335	−0.05		
Factor III. Self as context	0.02	−0.27	0.31	0.01	0.895	0.01		
Factor IV. Defusion	−0.20	−0.49	0.08	−0.12	0.167	−0.07		
Factor V. Values	0.11	−0.16	0.39	0.07	0.409	0.04		
Factor VI. Committed action	−0.07	−0.33	0.19	−0.04	0.602	−0.03		
Factor VII. Experiential avoidance	0.09	−0.13	0.31	0.05	0.411	0.04		
Factor VIII. Lack of contact with the present moment	−0.07	−0.27	0.14	−0.04	0.516	−0.03		
Factor IX. Self as content	−0.17	−0.38	0.04	−0.12	0.121	−0.08		
Factor X. Fusion	0.03	−0.24	0.30	0.02	0.853	0.01		
Factor XI. Lack of contact with values	0.23	0.00	0.47	0.15	0.051	0.10		
Factor XII. Inaction	−0.10	−0.35	0.14	−0.07	0.414	−0.04		

Note. $n = 309$. Statistics of Step 3 are shown for each variable. In Gender, female = 0 and male = 1. The reference variable for age is being 18–29 years old. The reference variable for marital status variables is being single. The reference variable for educational level variables is primary education. Significant *p*-values of predictors are in bold. ΔR^2 was statistically significant in the three steps ($p \leq 0.01$) except for the BPI-SF from Step 2 to 3.

Abbreviations: *B*, unstandardized beta values; CPAQ, Chronic Pain Acceptance Questionnaire; PIPS, Psychological Inflexibility in Pain Scale; R^2, coefficient of determination; sr, semi-partial correlation coefficient; *β*, standardized beta values; ΔR^2, coefficient of determination change.

variance explained by the model of HADS-T and BPI-interference scores was 41.10% and 28.4%, respectively. Finally, MPFI-24 subscale scores were entered in Step 3 and explained an additional 27.30% of HADS-T scores ($F(26, 282) = 23.48$, $p < 0.001$), $\Delta R^2 = 0.273$, ΔF (12, 282) = 20.32, $p < 0.001$, and an additional 3.1% of BPI-interference scores, $\Delta R^2 = 0.031$, ΔF (12, 282) = 1.06, $p = 0.397$.

In the final model, among the MPFI-24 measurements, Factor I-Acceptance ($sr = 0.08$, $p = 0.016$), Factor V-Values ($sr = -0.08$, $p = 0.020$), Factor VIII-Lack of contact with the present moment ($sr = 0.07$, $p = 0.044$), Factor X-Fusion ($sr = 0.11$, $p = 0.001$) and Factor XII-Inaction ($sr = 0.11$, $p < 0.001$) significantly explained the HADS-T scores, while Factor II-Present moment awareness ($sr = -0.03$, $p = 0.318$), Factor III-Self as context ($sr = -0.06$, $p = 0.098$), Factor IV-Defusion ($sr = -0.01$, $p = 0.675$), Factor VI-Committed action ($sr = -0.02$, $p = 0.653$), Factor VII-Experiential avoidance ($sr = -0.01$, $p = 0.732$), Factor IX-Self as content ($sr = -0.02$, $p = 0.627$) and Factor XI-Lack of contact with values ($sr = 0.05$, $p = 0.165$) did not. On the contrary, MPFI-24 subscale scores did not significantly explain the BPI-interference scores.

Table 7 summarizes the results of the hierarchical multiple regression analyses for Psy-Flex. Initially, sociodemographic variables were entered in Step 1. In Step 2, the CPAQ and PIPS scores were added. Upon introducing the Psy-Flex scores in Step 3, an additional 14% of the variance in the HADS-T scores was explained, which was statistically significant ($F(15, 293) = 23.97$, $p < 0.001$). This change in R squared was significant ($\Delta R^2 = 0.14$, ΔF (1, 293) = 91.56, $p < 0.001$). Additionally, Psy-Flex scores accounted for an extra 1% of the variance in BPI-interference scores, which was also significant ($F(15, 293) = 8.12$, $p < 0.001$), $\Delta R^2 = 0.01$, ΔF (1, 293) = 4.20, $p = 0.041$. In the final model, Psy-Flex contributed significantly to explaining variations in both HADS-T ($sr = -0.38$, $p < 0.001$) and BPI-interference ($sr = -0.10$, $p = 0.041$).

TABLE 7 Hierarchical multiple regression analysis predicting HADS and BPI-SF total scores with Psy-Flex.

		95% CI for B						
Predictor variables	***B***	**LL**	**UL**	***β***	***p***	**sr**	R^2	ΔR^2
Dependent variable: HADS-T								
Constant	33.52	24.22	42.81		0.000		0.11	0.11
Gender	0.30	−1.76	2.35	0.01	0.776	0.01		
Age (30–39 years)	0.80	−1.76	3.36	0.04	0.539	0.02		
Age (40–49 years)	0.94	−1.57	3.45	0.05	0.461	0.03		
Age (50–59 years)	0.92	−1.68	3.53	0.05	0.486	0.03		
Age (60–69 years)	1.87	−1.36	5.09	0.07	0.255	0.05		
Age (70–79 years)	3.58	−8.45	15.61	0.02	0.559	0.02		
Married	−0.08	−1.67	1.52	−0.01	0.923	−0.00		
Divorced	−0.72	−3.17	1.72	−0.03	0.560	−0.02		
Widowed	−9.09	−20.57	2.40	−0.06	0.120	−0.06		
Secondary education	−2.53	−5.21	0.15	−0.15	0.064	−0.07		
University degree	−2.17	−4.88	0.53	−0.13	0.115	−0.06		
Work (0 = not working; 1 = working)	−1.34	−2.77	0.09	−0.08	0.066	−0.07		
CPAQ	−0.10	−0.16	−0.03	−0.20	**0.004**	−0.11	0.41	0.30
PIPS	1.55	0.56	2.55	0.22	**0.002**	0.12		
Psy-Flex	−0.74	−0.89	−0.58	−0.43	**0.000**	−0.38	0.55	0.14
Dependent variable: BPI-SF								
Constant	6.69	3.96	9.41		0.000		0.09	0.09
Gender	−0.69	−1.29	−0.09	−0.11	**0.025**	−0.11		
Age (30–39 years)	0.68	−0.07	1.43	0.14	0.074	0.09		
Age (40–49 years)	0.34	−0.40	1.07	0.08	0.370	0.04		
Age (50–59 years)	0.36	−0.41	1.12	0.08	0.360	0.04		
Age (60–69 years)	−0.09	−1.03	0.86	−0.01	0.853	−0.01		
Age (70–79 years)	−0.38	−3.91	3.14	−0.01	0.832	−0.01		
Married	−0.04	−0.51	0.43	−0.01	0.870	−0.01		
Divorced	0.06	−0.65	0.78	0.01	0.861	0.01		
Widowed	−0.41	−3.77	2.96	−0.01	0.811	−0.01		
Secondary education	0.07	−0.71	0.86	0.02	0.854	0.01		
University degree	−0.19	−0.98	0.61	−0.05	0.642	−0.02		
Work (0 = not working; 1 = working)	−0.17	−0.59	0.25	−0.04	0.428	−0.04		
CPAQ	−0.02	−0.04	0.00	−0.21	**0.014**	−0.12	0.28	0.19
PIPS	0.39	0.10	0.68	0.24	**0.008**	0.13		
Psy-Flex	−0.05	−0.09	0.00	−0.12	**0.041**	−0.10	0.29	0.01

Note: $n = 309$. Statistics of Step 3 are shown for each variable. In Gender, female = 0 and male = 1. The reference variable for age is being 18–29 years old. The reference variable for marital status variables is being single. The reference variable for educational level variables is primary education. Significant *p*-values of predictors are in bold. ΔR^2 was statistically significant in the three steps ($p \leq 0.05$).

Abbreviations: *B*, unstandardized beta values; CPAQ, Chronic Pain Acceptance Questionnaire; PIPS, Psychological Inflexibility in Pain Scale; R^2, coefficient of determination; sr, semi-partial correlation coefficient; *β*, standardized beta values; ΔR^2, coefficient of determination change.

4 | DISCUSSION

This study aimed to examine the psychometric properties of the MPFI-24 and Psy-Flex in Spanish adults experiencing chronic pain. The first aim was to examine the dimensionality of both self-report measures. We hypothesized that a hierarchical model (Figure 1e) featuring twelve 2-item factors, each corresponding to one of the 12 processes delineated in the Hexaflex model, and collectively forming two higher order latent

factors representing PF and PI, would provide the best fit for the MPFI-24 (Hypothesis 1a). However, CFA suggested significant uncertainty in the MPFI-24´s internal structure. Subsequent post hoc exploratory analyses showed that the model comprising twelve 2-item correlated factors (Figure 1c) fit best. It is important to note that having more items per factor is known to provide more stable estimates, particularly in studies with small sample sizes (Moshagen & Musch, 2014). Indeed, it is typically recommended that each factor include at least three items to ensure model identification in CFA (Kline, 2016). Although the bifactor model (Figure 1f) also demonstrated a good fit, the correlated factors model was preferred based on the principle of parsimony and the absence of empirical support in prior studies for the bifactor model with one single general PF/PI factor. Consequently, Hypothesis 1a is not supported. According to the present results, we recommend that the Spanish version of the MPFI-24 be scored using only 12 subscale scores. The supported twelve 2-item correlated factors structure encapsulates all primary facets of PF and PI as described in the Hexaflex model (Hayes et al., 2011). In contrast to our results, previous factor analyses of the MPFI-24 in English and French general populations indicated that the model with two higher order factors provided the best fit to the data (Grégoire et al., 2020; Pereira et al., 2023). Similarly, Sundström et al. (2023) also found evidence supporting this hierarchical structure in a sample of individuals with pain using the full MPFI.

Regarding the dimensionality of the Psy-Flex, it was expected that a one-factor model incorporating all six items to form a single latent factor of PF would provide the best fit (Hypothesis 1b). CFA supported a robust single-factor structure for the Psy-Flex, thus confirming Hypothesis 1b. Additionally, model fit improved when the correlated residuals of two items where included, consistent with findings from the original study by Gloster et al. (2021) and the subsequent Korean validation by Jo et al. (2023). These findings indicate that respondents might perceive an implicit overlap between knowing one's personal values (Item 5) and acting in accordance to those values (Item 6). This overlap is not fully captured by the one-factor model. According to the Triflex model proposed by Hayes et al. (2012), both items explicitly measure an engaged response style, a concrete aspect of PF, providing a theoretical rationale congruent with ACT for the observed strong covariance between these items and others. Conversely, the other two pair of items bound to the open response (Items 2 and 3) and the centred response styles (Items 1 and 4) did not demonstrate similar patterns. Therefore, method effects, as suggested by the original authors (Gloster et al., 2021), such as similarities in item wording may better explain these findings (e.g. Item 5: 'I determine what's important for me [...]' and Item 6: 'I engage thoroughly in things that are important [...] to me').

The second aim was to estimate the internal consistency of the Spanish versions of the MPFI-24 and the Psy-Flex instruments. We hypothesized that the MPFI-24 would demonstrate adequate internal consistency (Hypothesis 2a). Results indicated that the PF factors—Self-as-Context, Defusion, Values and Committed Action—and the PI factors—Avoidance, Lack of Contact with the Present, Self-as-Content, Fusion, Lack of Values and Inaction—of the MPFI-24 exhibited good internal consistencies. Conversely, the Acceptance factor did not exhibit adequate consistency. This finding aligns with those of Grégoire et al., who reported low Cronbach's alpha values for this subscale among university students in 2020. Similarly, Pereira et al. (2023) and Sundström et al. (2023) found good evidence supporting the reliability of all the individual factors. It remains unclear why this subscale showed lower internal consistency values here. As a possible explanation, one of the two items of this subscale (Item 1) cross-loaded and was significantly associated with other items and factors, which influences both indices of internal consistency calculated here (Zinbarg et al., 2005). Hence, Hypothesis 2a is partially supported. Regarding the Psy-Flex, we anticipated it would demonstrate adequate internal consistency (Hypothesis 2b). Consistent with its original validation (Gloster et al., 2021) and its validation in a Korean sample (Jo et al., 2023), the Psy-Flex showed good internal consistency in this study. Therefore, Hypothesis 2b is supported. Notably, this study computed not only Cronbach's alpha but also McDonald's omega values for both the MPFI-24 and Psy-Flex, in accordance with recent methodological recommendations (e.g. Hayes & Coutts, 2020; McNeish, 2018).

The third aim of this study was to evaluate the convergent validity of the Spanish versions of the MPFI-24 and the Psy-Flex. We hypothesized positive associations between the PF subscales of the MPFI-24 and Psy-Flex scales and chronic pain acceptance, as measured by the CPAQ, and negative associations with PI (PIPS), pain interference (BPI-SF), pain catastrophizing (PCS), pain-related fear (TSK) and symptoms of anxiety and depression (HADS; Hypotheses 3a and 3b). Conversely, we expected an inverse correlation pattern for the PI subscales of the MPFI-24 (Hypothesis 3a). The MPFI-24 subscales of Present Moment Awareness, Self as Context, Defusion, Values, and Committed Action, Lack of Contact with the Present Moment, Self as Content, Fusion, Lack of Contact with Values and Inaction, alongside the Psy-Flex scale, showed the expected of relationship patterns in accordance with ACT principles concerning measures of PF and PI (i.e. CPAQ and PIPS) and pain-related constructs (i.e. BPI-SF,

PCS, TSK and HADS). However, the Acceptance and Experiential Avoidance subscales of the MPFI-24 diverged from this expected pattern. Specifically, the Acceptance subscale showed no significant associations with any measure, while the Experiential Avoidance subscale showed weak associations with all variables and a positive correlation with PF measures (Psy-Flex and CPAQ), partially supporting Hypothesis 3a and fully supporting Hypothesis 3b. Recent studies, such as those by Grégoire et al. (2020) and Pereira et al. (2023) have found that the Experiential Avoidance subscale within the MPFI-24 does not correlate well with the Psy-Flex and measures of well-being, distress and life satisfaction in the general population. In addition, Sundström et al. (2023) observed similar findings in a chronic pain sample using the full MPFI, where the Acceptance subscale did not significantly correlate with the CPAQ, and the Experiential Avoidance subscale did not align with the other PI subscales. In summary, the Experiential Avoidance subscale has repeatedly failed in the convergent validity tests across three validation studies of the MPFI-24, which include samples from the general population (Grégoire et al., 2020; Pereira et al., 2023) and those with chronic pain (this study). This failure suggests that the chosen items for this subscale may not effectively measure this construct, regardless of the language (English, French, Portuguese or Spanish). This issue could stem from the origin of the items—whether they were obtained from the most suitable questionnaire—and/or the wording of the items, which may have led to misunderstandings or incorrect interpretations related to PF/PI. For the Acceptance subscale, an implicit bias in the chronic pain population seems to be a more likely explanation for its difficulty in demonstrating convergence, as this phenomenon has been exclusively reported in studies involving chronic pain samples for both the MPFI (Sundström et al., 2023) and the MPFI-24 (this study).

Finally, we anticipated that the MPFI-24 and Psy-Flex would explain a significant additional proportion of the variance in psychological distress and pain interference, beyond what is accounted by the CPAQ and PIPS (Hypotheses 4a and 4b). Our findings demonstrated significant incremental validity of the MPFI-24 over sex, age, marital status, educational level, work status, chronic pain acceptance (CPAQ) and psychological inflexibility toward pain (PIPS). The MPFI-24 explained a substantial additional variance in psychological distress, though it did not do so for pain interference. Hence, Hypothesis 4a was partially supported. Meanwhile, the incremental validity observed in the Psy-Flex was both significant and substantial, accounting for a considerable additional variance in psychological distress and a modest proportion of variance in pain interference. Therefore, Hypothesis 4b was supported. These results align with the additional processes of the Hexaflex model incorporated into the MPFI-24 and Psy-Flex relative to the CPAQ and PIPS measures. Notably, the MPFI-24 explains almost double the variance of psychological distress compared to Psy-flex. This might be due to the PI subscales, especially lack of contact with the present moment, fusion and inaction. This supports earlier findings regarding the MPFI's unique contribution to understanding levels of psychological distress and overall well-being, surpassing that of unidimensional scales such as the Acceptance and Action Questionnaire-II (AAQ-II, Bond et al., 2011; Rogge et al., 2019). However, this advantage of MPFI-24 over Psy-Flex was not found for pain interference. These results are notable because there is a classical debate about the use of generic versus disease-specific instruments in several areas of research (Patrick & Deyo, 1989). While generic instruments (e.g. MPFI-24 and Psy-Flex) have a transdiagnostic application across different types and severities of conditions, disease-specific measures (e.g. CPAQ and PIPS) are designed for the measurement of constructs in particular diseases or patient populations. Both approaches have their pros and cons. Generic measures are important for comparing outcomes across different samples and treatments, and they are particularly helpful for economic evaluation studies. Disease-specific measures can be more sensitive to changes in specific diagnostic groups. Overall, MPFI-24 and Psy-Flex, though they are generic measures, have additional values in understanding the processes of psychological flexibility.

A limitation of this study is that the translation and adaptation of the instrument did not fully adhere to specialized guidelines, such as those suggested by Sousa and Rojjanasrirat (2011). Specifically, the methodology would have benefitted by employing two independent translations in both the forward and back-translation phases, and with the involvement of a team of independent translators. In addition, the participants' diagnoses could not be verified by a healthcare professional. Notably, a considerable portion of the sample reported experiencing at least two chronic pain types, leading to uncertainty regarding the specific type of chronic pain each participant experienced. Consequently, this variable could not be included in the analysis. Finally, the circumstances in which participants answered the survey were unknown, potentially introducing bias into the study's measurements. To mitigate these limitations in future research, it is recommended that participants with a medically confirmed diagnosis of chronic pain be involved. Furthermore, future studies should consider evaluating the stability of the MPFI-24 and Psy-Flex scores over time to establish test–retest reliability and responsiveness.

In conclusion, the findings of this study recommend that Spanish-speaking practitioners and researchers in chronic pain consider using the MPFI-24 alongside

specific measures of acceptance and experiential avoidance. Recommended measures include the FFMQ-15 (Feliu-Soler et al., 2021) and the Brief Experiential Avoidance Questionnaire (Vázquez-Morejón et al., 2019). Given the factor structure of the MPFI-24, it is advisable to use the 12 subscales independently rather than computing total scores for flexibility and inflexibility. Concurrently, the Spanish Psy-Flex has proven to be a reliable and valid self-report measure that offers a single score for PF. When comparing these measures, Psy-Flex is particularly suited for research in chronic pain due to its brevity, which is advantageous for intensive longitudinal studies. In contrast, the MPFI-24 is likely more useful in clinical settings, as the subscales provide additional insights into PI. Overall, in chronic pain research and clinical management, both measures are informative beyond what is provided by current widely used measures regarding psychological distress and pain interference (only Psy-Flex), including the CPAQ and PIPS.

AUTHOR CONTRIBUTIONS

JN, JPS-M, RN, AF-S and JVL conceived of and designed the study. MS provided clinical psychology input to the design. JN and JVL analysed the data. JN and CR-F wrote the first draft of the manuscript. JPS-M assisted in the final drafting and editing of the manuscript. All the authors had the opportunity to contribute to the interpretation of the results and revise the manuscript for intellectual content.

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CONFLICT OF INTEREST STATEMENT

We have no known conflict of interest to disclose.

ORCID

Jaime Navarrete https://orcid.org/0000-0002-9482-4822
Juan V. Luciano https://orcid.org/0000-0003-0750-1599

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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