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Psychometric Validation of the Turkish Version of the Personalized Psychological Flexibility Index (T-PPFI) in Disaster Search and Rescue Volunteers

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ABSTRACT

This study aimed to perform a cross-cultural adaptation of the English version of the Personalized Psychological Flexibility Index into Turkish (T-PPFI). It was conducted among 604 disaster search and rescue volunteers who participated in the 2023 Kahramanmaraş earthquakes in Türkiye. Exploratory factor analysis supported a three-factor, 15-item structure, and confirmatory factor analysis indicated good fit for the three-factor model. Convergent and divergent validity were supported by a positive correlation with the Comprehensive Assessment of Acceptance and Commitment Therapy Processes (CompACT) and negative correlations with the Acceptance and Action Questionnaire-II (AAQ-II) and the Depression Anxiety and Stress Scales-21 (DASS-21). The T-PPFI showed acceptable internal consistency (total score $\alpha = .727$; $\omega = .712$) and high test-retest reliability over 14 days ($r = .962$). Gender measurement invariance analyses supported comparability of T-PPFI scores across men and women. Hierarchical regression analyses provided evidence for the incremental validity of the T-PPFI beyond AAQ-II and CompACT in predicting DASS-21 outcomes, and higher-order EFA supported construct-level discriminant validity. The findings suggest that the 15-item T-PPFI is a reliable and valid measure of psychological flexibility in Turkish disaster search and rescue volunteers.

Key words: Personalized Psychological Flexibility Index, psychological flexibility, reliability, validity.

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Novelty and Significance

What is already known about the topic?

- Disaster search and rescue personnel may be exposed to intense stressors and traumatic scenes during operations.
- Psychological flexibility is linked to better coping and wellbeing, but widely used measures have been criticized for conceptual and psychometric limitations.

What this paper adds?

- It provides the first Turkish adaptation and psychometric validation of the PPFI in disaster search and rescue volunteers.
- It supports a three-factor, 15-item structure with evidence of reliability, convergent/divergent validity, incremental validity, and gender measurement invariance.

Disaster workers include professionals and volunteers who respond to injuries, provide emergency support, and help maintain public safety during natural and human-made disasters. Search and rescue volunteers, in particular, often work in high-risk environments, make rapid decisions under time pressure, and are repeatedly exposed to distressing scenes (Alexander & Klein, 2009; Benedek, Fullerton, & Ursano, 2007). Such operational demands and traumatic exposures have been linked to elevated psychological distress and mental health symptoms among disaster responders, including anxiety, depression, and posttraumatic stress reactions (Chang *et alii*, 2003; Marmar, Weiss, Metzler, Ronfeldt, & Foreman, 2006; Perrin *et alii*, 2007). Identifying protective processes

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that may support responders' functioning and wellbeing is therefore an important priority.

Psychological flexibility is usually framed as staying in contact with difficult thoughts and feelings without being driven by them; action still follows what matters -values, commitments, goals (Hayes, Villatte, Levin, & Hildebrandt, 2011; Kashdan & Rottenberg, 2010). In stressful settings the pattern is consistent: higher flexibility goes with better adjustment and fewer distress-linked problems (Bryan, Ray-Sannerud, & Heron, 2015; McCracken & Morley, 2014; White *et alii*, 2013). Disaster response work brings a particular test of this capacity: uncertainty, fatigue, emotional load; tasks still must be completed.

Measurement is the sticking point. Cherry, Vander Hoeven, Patterson, and Lumley (2021) describe a crowded field of instruments, with notable variation in what is emphasized and how cleanly scores map onto the construct; conceptual and psychometric questions appear repeatedly. The Acceptance and Action Questionnaire-II (AAQ-II; Bond *et alii*, 2011) illustrates the issue: it is widely used, yet in some contexts it tracks general distress/negative affect more strongly than the intended target of psychological inflexibility (Rocheftort, Baldwin, & Chmielewski, 2018; Wolgast, 2014). This gap -definition versus what a score may actually reflect- has pushed the literature toward measures with tighter theoretical alignment and stronger validity evidence across samples.

The Personalized Psychological Flexibility Index (PPFI) was created to address these nuances by assessing flexibility specifically within the context of pursuing a personally meaningful goal, thus adding a necessary idiographic element to the measurement (Kashdan, Disabato, Goodman, Doorley, & McKnight, 2020). The PPFI is structured around three dimensions: Avoidance, which reflects the tendency to disengage or be held back by distressing internal experiences; Acceptance, which captures the willingness to experience discomfort while staying on course; and Harnessing, the capacity to utilize difficult emotions or stress as energy or information to fuel goal-consistent action. By anchoring items to a self-nominated goal, the PPFI attempts to capture flexibility as it relates to meaningful striving -a framing that is likely highly applicable to high-stakes occupational or volunteer settings (Doorley, Goodman, Kelso, & Kashdan, 2020).

Growing evidence supports the utility of the PPFI across diverse cultural contexts. Studies have largely confirmed its three-factor structure and provided reliability and validity evidence among Iranian community samples (Akbari, Disabato, Seydavi, & Zamani, 2021), as well as Chinese college students (Fang, Huang, & Wang, 2023), medical students (Jiang *et alii*, 2024), and cancer patients (Xia *et alii*, 2023). While item-level analysis suggests the PPFI is a promising tool, researchers emphasize the need for continued evaluation across different groups (Jo, Im, Suh, Spencer, & Masuda, 2023). To our knowledge, the PPFI has not yet been validated among Turkish disaster search and rescue volunteers -a specific population for whom accurate assessment could significantly improve screening, training, and targeted psychosocial support.

The present study aimed to adapt the PPFI into Turkish (T-PPFI) and evaluate its psychometric properties among search and rescue volunteers who responded to the 2023 Kahramanmaraş earthquakes in Türkiye. We investigated the factor structure using both exploratory and confirmatory factor analyses, estimated internal consistency and test-retest reliability, and assessed convergent and divergent validity by looking at associations with theoretically related constructs (CompACT) and distinct ones (AAQ-II, DASS-21). Furthermore, we tested for measurement invariance across gender and examined the scale's incremental validity in predicting negative emotional states beyond established measures. We hypothesized a three-factor structure consistent with the original PPFI,

positive correlations with CompACT, negative correlations with AAQ-II and DASS-21, and evidence of gender invariance.

METHOD

Participants

The target population comprised Disaster and Emergency Management Authority (AFAD) disaster search and rescue volunteers who participated in search and rescue activities during the 2023 Kahramanmaraş earthquakes in Türkiye. According to AFAD (2023), there were 1,456,605 AFAD search and rescue volunteers nationwide and 39,012 volunteers participated in the 2023 Kahramanmaraş earthquake response.

A convenience sampling approach was used. Inclusion criteria were (a) being an AFAD volunteer and (b) having participated in search and rescue activities during the 2023 Kahramanmaraş earthquakes. Data were collected between 03 March 2025 to 14 April 2025; thus, the time elapsed since the earthquakes at assessment was 26 months.

A total of 625 questionnaires were received through combined online and face-to-face administration. Twenty-one cases were excluded due to excessive missing data and responses inconsistent with inclusion criteria, resulting in a final sample of 604 participants. Demographic characteristics are reported in Table 1 (gender, age, marital status, educational status, and occupation). In brief, the sample included 305 men (50.5%) and 299 women (49.5%); most participants were aged 31-40 (37.9%) and held a bachelor's degree (64.9%).

Although there are different recommendations for sample size in multivariate analyses, a common rule of thumb is to recruit at least five participants per item (DeVellis & Thorpe, 2022; Lomax & Hahs-Vaughn, 2013). Given that the PPFİ includes 15 items, the final sample ($N= 604$) was considered adequate for the planned analyses.

Design

This study used a cross-sectional psychometric validation design to adapt the Personalized Psychological Flexibility Index into Turkish and evaluate its factor structure, reliability, and validity in disaster search and rescue volunteers. The dataset was randomly split into two equal subsamples for exploratory ($n1$) and confirmatory ($n2$) factor analyses.

Instruments and Measures

Personalized Psychological Flexibility Index (PPFİ; Kashdan *et alii*, 2020). The PPFİ was used to assess psychological flexibility in the pursuit of a personally meaningful, work-related goal despite distress. Before responding, participants were instructed to identify one personally meaningful goal related to their disaster/emergency work activities and to answer all items with that goal in mind. The instrument consists of 15 items and three 5-item dimensions: Avoidance (Items 1-5), Acceptance (Items 6-10), and Harnessing (Items 11-15). Items were rated on a 7-point Likert-type scale ranging from 1 ("strongly disagree") to 7 ("strongly agree"). Example item (paraphrased): "Even if I feel unpleasant emotions while pursuing my goal, I can stay aware of them without getting carried away." Items were scored according to the original scoring logic. Avoidance items are negatively keyed with respect to psychological flexibility; therefore, Avoidance items were reverse-coded when computing the total psychological flexibility score. Higher total scores indicate greater psychological flexibility. Permission to adapt the PPFİ was obtained from the original author. The scale was translated into Turkish independently by two academics in English language and literature. The translations were reconciled into a single version and reviewed by the research team

for conceptual equivalence. To evaluate clarity and cognitive equivalence, cognitive debriefing was conducted with ten undergraduate students in emergency aid and disaster management; participants paraphrased each item and explained their responses. Based on feedback, necessary wording adjustments were made. The final Turkish version was back-translated into English by the same two translators and reviewed against the original version. Internal consistency was acceptable for the total score ($\alpha = .727$; $\omega = .712$). Subscale reliability was high (Avoidance: $\alpha = .956$; $\omega = .957$; Harnessing: $\alpha = .967$; $\omega = .970$; Acceptance: $\alpha = .858$; $\omega = .875$).

Acceptance and Action Questionnaire-II (AAQ-II; Bond *et alii*, 2011). The AAQ-II was used to assess psychological inflexibility/experiential avoidance for divergent validity comparisons. The AAQ-II includes 7 items rated on a 7-point scale ranging from 1 (“never true”) to 7 (“always true”). Example item (paraphrased): “Painful thoughts and memories make it hard for me to live the life I value.” Higher scores indicate greater psychological inflexibility. Although a Turkish AAQ-II has been published, we used a de novo Turkish translation to maintain consistent wording and response interpretation across the full questionnaire battery. The translation procedure followed the same steps described for the PPF1. Internal consistency was excellent ($\alpha = .979$).

Comprehensive Assessment of Acceptance and Commitment Therapy Processes (CompACT; Francis, Dawson, & Golijani-Moghaddam, 2016). The CompACT was used as a conceptually related measure to evaluate convergent validity. The scale consists of 23 items assessing ACT-related processes across three dimensions (Openness to Experience, Behavioral Awareness, and Valued Action). Participants responded on a 7-point scale from 1 (“strongly disagree”) to 7 (“strongly agree”). Example item (paraphrased): “I take actions that are consistent with what matters to me.” Although Turkish versions of CompACT have been published, we used a de novo Turkish translation to ensure consistent terminology and administration across the full questionnaire package and to maximize comprehensibility for disaster search and rescue volunteers. The same forward-translation, reconciliation, back-translation, and cognitive debriefing approach described for the PPF1 was applied. Internal consistency for the CompACT total score was high ($\alpha = .933$).

Depression Anxiety Stress Scale-21 (DASS-21; Lovibond & Lovibond, 1995). The DASS-21 was used to assess negative emotional symptoms for divergent validity comparisons. The DASS-21 contains 21 items measuring Depression, Anxiety, and Stress (7 items each). In this study, items were administered using a 4-point response format from 1 (“Did not apply to me at all”) to 4 (“Applied to me very much or most of the time”). Example item (paraphrased): “I found it difficult to relax.” Higher scores indicate higher symptom levels. Although Turkish versions of the DASS-21 have been published, we used a de novo Turkish translation to ensure consistent terminology and administration across measures. The translation procedure followed the same steps described for the PPF1. Internal consistency for the total DASS-21 score was high ($\alpha = .971$).

Procedure

Ethical approval for the study was obtained from the Bayburt University Ethics Committee (Code: BSNBLT3CVC; Pin: 95282; Issue: E51694156-050.04-26326). Participation was voluntary. Before starting the questionnaire, participants were informed about the purpose of the study, confidentiality/anonymity of responses, and their right to withdraw at any time without penalty, and they provided informed consent.

A pilot administration was conducted with 50 eligible AFAD disaster search and rescue volunteers to evaluate item clarity, comprehensibility, and administration time. The pilot was administered by the researchers using a face-to-face format. Participants were asked to indicate any unclear wording or response difficulties. Based on immediate feedback, minor wording and formatting adjustments were made to the questionnaire package. The average completion time in the pilot ranged from 7 to 12 minutes.

For the main study, data were collected between 03.03.2025 and 14.04.2025 using a combination of online and face-to-face survey administration. Eligibility was checked based on self-report of being an AFAD volunteer and having participated in search and

rescue activities during the 2023 Kahramanmaraş earthquakes. The survey began with the goal-setting instruction required by the PPFİ, followed by the remaining measures and the demographic questions. A total of 625 questionnaires were received; 21 were excluded due to excessive missing data and responses inconsistent with the inclusion criteria, resulting in a final sample of 604 participants for analysis.

To assess temporal stability, 50 participants were randomly selected from the final sample and were invited to complete the same questionnaire package again 14 days after the initial administration.

Data Analysis

All analyses were conducted using SPSS v21 and AMOS v22. Prior to inferential analyses, data were screened for completeness and distributional assumptions. Questionnaires with extensive missing data were excluded; for retained questionnaires, up to 5% missing data was permitted. Descriptive statistics (means, standard deviations) were computed for study variables.

To cross-validate the factor structure, the full dataset ($N=604$) was randomly split into two equal subsamples using the Random Sample of Cases function in SPSS ($n1=302$, $n2=302$). The $n1$ subsample was used for exploratory factor analysis (EFA) and the $n2$ subsample for confirmatory factor analysis (CFA).

An EFA was conducted on $n1$ to examine the underlying structure of the Turkish PPFİ. Data extraction used principal components analysis with Direct Oblimin rotation. Sampling adequacy was evaluated with the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity. Factor retention was guided by eigenvalues greater than 1 and interpretability. Items were retained if they showed primary loadings of $\geq .50$, acceptable communalities (target $\geq .50$), and no problematic cross-loadings (cross-loadings $> .30$ or loading differences $< .10$ were considered grounds for removal) (Tucker & MacCallum, 1997; Field, 2009; Hooper, 2012).

CFA was performed on $n2$ to test competing models (one-factor, two-factor, and three-factor). Model fit was evaluated using χ^2/df , *GFI*, *AGFI*, *NFI*, *CFI*, *IFI*, *TLI*, and *RMSEA*, following conventional SEM reporting practices (Hu & Bentler, 1999). Modification indices were inspected and model modifications were applied only when they were theoretically justifiable.

Internal consistency was evaluated using Cronbach's α and McDonald's ω . Composite reliability (*CR*) and maximum reliability (*MaxR(H)*) were computed as additional reliability indices. Convergent validity was examined using Average Variance Extracted (*AVE*) (with *AVE* $\geq .50$ as supportive evidence). Discriminant validity was evaluated by comparing *MSV* with *AVE* (*MSV* $<$ *AVE* as supportive) and by inspecting *HTMT* ratios (values < 1.00 considered supportive) (Gaskin & Lim, 2016). Test-retest reliability was examined using Pearson correlations across a 14-day interval in a randomly selected subsample ($n=50$).

Measurement invariance across gender was assessed using multi-group CFA in sequential steps: configural, metric, scalar, and strict invariance (Chen, 2008). Invariance decisions were based on changes in fit indices, with ΔCFI , ΔTLI , and $\Delta RMSEA$ values $< .015$ indicating support for invariance (Jin, 2020).

Convergent and divergent validity were assessed via Pearson correlations between T-PPFİ scores and scores from the CompACT, AAQ-II, and DASS-21 (two-tailed tests).

To examine discriminant validity at the construct level, a higher-order EFA was conducted using the subscale mean scores of T-PPFİ (Avoidance, Acceptance, Harnessing), DASS-21 (Depression, Anxiety, Stress), and AAQ-II as observed indicators, using principal axis factoring with Direct Oblimin rotation (Kashdan *et alii*, 2020). Incremental validity was examined through hierarchical regression analyses predicting DASS-21 Depression, Stress, and Anxiety. Step 1 included AAQ-II and CompACT;

Step 2 added the three T-PPFI subscales. Model performance was evaluated using R^2 and ΔR^2 , along with standardized regression coefficients.

Unless otherwise specified, statistical significance was evaluated using two-tailed tests with an alpha level of .05.

RESULTS

Table 1 presents the demographic characteristics of the participants. The sample included 305 men (50.5%) and 299 women (49.5%). The largest age group was 31-40 years (37.9%). Most participants were unmarried (54.1%), held a bachelor's degree (64.9%), and were government employees (41.9%).

Table 1. Demographic characteristics of participants.
($N=604$)

Characteristic	Category	<i>n</i> (%)
Gender	Male	305 (50.5)
	Female	299 (49.5)
Age	18-30	191 (31.6)
	31-40	229 (37.9)
	41-50	111 (18.4)
	51-65	73 (12.1)
Marital status	Married	277 (45.9)
	Unmarried	327 (54.1)
Educational status	Associate's degree	139 (23.0)
	Bachelor's degree	392 (64.9)
	Master's degree	62 (10.3)
	Doctorate degree	11 (1.8)
Occupation	Private sector employee	98 (16.2)
	Government employee	253 (41.9)
	Self-employed	39 (6.5)
	Farmer	18 (3.0)
	Student	104 (17.2)
	Housewife	43 (7.1)
	Unemployed	37 (6.1)
	Other	12 (2.0)

First, the analysis of the results did not reveal any outliers in the data, as the skewness values ranged from 0.428 to 2.010, and the kurtosis values from 0.008 to 2.763, supporting the idea that these were acceptable univariate distributions.

Exploratory factor analysis was conducted on subsample $n1$ (see Table 2). Sampling adequacy was supported ($KMO=0.831$), and Bartlett's test of sphericity was significant

Table 2. T-PPFI item descriptives and factor loadings (EFA; $n1=302$).

Item	<i>M</i>	<i>SD</i>	Harnessing	Acceptance	Avoidance	<i>h</i> ²	<i>I-T</i>	α if item deleted
Harnessing 1	6.11	1.675	.903			.820	.532	.730
Harnessing 2	5.95	1.869	.970			.941	.560	.725
Harnessing 3	6.03	1.634	.876			.767	.565	.727
Harnessing 4	5.62	1.747	.953			.906	.579	.724
Harnessing 5	5.72	1.790	.967			.937	.549	.727
Acceptance 1	2.15	.977		.783		.612	.283	.754
Acceptance 2	2.72	1.226		.769		.604	.221	.758
Acceptance 3	2.98	1.498		.776		.654	.241	.758
Acceptance 4	3.17	1.380		.717		.517	.261	.756
Acceptance 5	3.26	1.407		.792		.624	.251	.756
Avoidance 1	2.71	1.649			.857	.758	.222	.760
Avoidance 2	2.50	1.574			.726	.524	.266	.756
Avoidance 3	3.17	1.925			.769	.592	.263	.759
Avoidance 4	2.98	1.575			.869	.765	.281	.755
Avoidance 5	3.13	1.424			.806	.647	.309	.752
Eigenvalue			4.544	3.237	2.886			
Variance explained (%)			30.293	21.580	19.238			
Total variance explained (%)			71.111					

Notes: h^2 = communalities; *I-T*= Item-Total correlation; α = Cronbach's alpha if item deleted.

($\chi^2= 3562.056$, $df= 105$, $p <.001$). Communalities ranged from 0.517 to 0.941. Three factors with eigenvalues greater than 1 were retained and explained 71.111% of the total variance. Pattern matrix loadings ranged from 0.717 to 0.970. Table 2 presents factor loadings and item statistics. For subsample *n1*, the total scale Cronbach's α was 0.760, and item-total correlations ranged from 0.221 to 0.579.

Confirmatory factor analysis was conducted on subsample *n2* (see Table 3) to compare one-factor, two-factor, and three-factor models. The three-factor model showed the best fit. After applying the suggested model modifications, fit indices improved further (final model; Table 3). Standardized factor loadings ranged from 0.626 to 0.986 (Table 4). The final measurement model is presented in Figure 1.

Table 3. T-PPF1 Confirmatory Factor Analysis model fit indices (CFA; $n2= 302$).

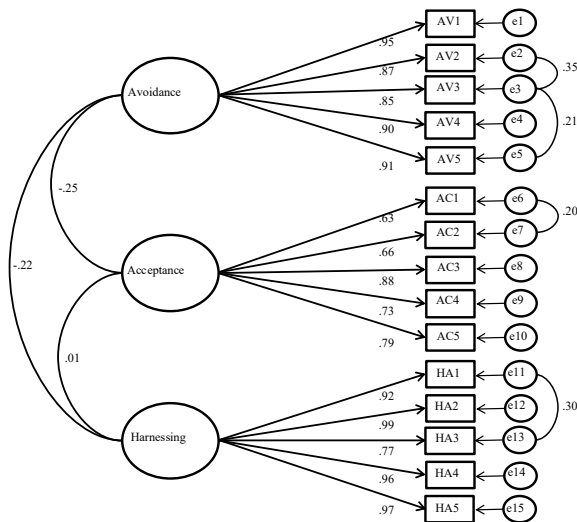
Model	χ^2/df	GFI	AGFI	NFI	CFI	IFI	TLI	RMSEA
One-factor	27.769	.406	.209	.480	.488	.489	.402	.298
Two-factor	9.797	.660	.541	.819	.833	.834	.804	.171
Three-factor	2.822	.907	.871	.949	.966	.966	.959	.078
Final model	2.110	.932	.902	.964	.980	.980	.975	.061

Notes: GFI= Goodness of Fit Index; AGFI= Adjusted Goodness of Fit Index; NFI= Normed Fit Index; CFI= Comparative Fit Index; IFI= Incremental Fit Index; TLI= Tucker-Lewis Index; RMSEA= Root Mean Square Error of Approximation.

Table 4. Regression weights of CFA results.

Path	Std E	Estimate	SE	CR	p
AV1	.954	1.000	—	—	—
AV2	.867	.818	.032	25.352	***
AV3	.850	.909	.038	23.755	***
AV4	.904	.882	.030	28.937	***
AV5	.907	.825	.028	29.265	***
AC1	.626	1.000	—	—	—
AC2	.659	1.132	.106	10.675	***
AC3	.884	2.261	.198	11.449	***
AC4	.726	1.382	.135	10.216	***
AC5	.793	1.558	.143	10.862	***
HA1	.917	1.000	—	—	—
HA2	.986	1.180	.032	36.720	***
HA3	.769	.777	.037	21.113	***
HA4	.955	1.077	.033	32.196	***
HA5	.972	1.104	.032	34.587	***

Notes: SE= Standard Error; CR= Critical Ratio; ***= $p <.001$; Std E= Standard Estimation.



CMIN/df= 2.110; GFI= .932; AGFI= .902; NFI= .964; CFI= .980; IFI= .980; TLI= .975; RMSEA= .061

Figure 1. Standardized factor structure and model fit indices.

Table 5 summarizes descriptive statistics and measurement quality indices for the T-PPFI. Internal consistency estimates were acceptable for the total score ($\alpha = .727$; $\omega = .712$) and high for the subscales (Avoidance: $\alpha = .956$; $\omega = .957$; Harnessing: $\alpha = .967$; $\omega = .970$; Acceptance: $\alpha = .858$; $\omega = .875$). Composite reliability and other model-based reliability/validity indices are reported in Table 5 (CR and $MaxR(H)$ values were above .80; AVE values exceeded .50). Discriminant validity indicators were also supported (MSV values were smaller than AVE , and $HTMT$ ratios were below 1.00; Table 5).

Table 5. Descriptive statistics, reliability, and validity indices for the T-PPFI.

Scale	Items	<i>M</i>	<i>SD</i>	Skewness	Kurtosis	α	ω
Global scale	15	3.827	.693	-.774	1.635	.727	.712
Avoidance (AV)	5	2.949	1.396	.686	-.557	.956	.957
Harnessing (HA)	5	5.853	1.731	-1.892	2.287	.967	.970
Acceptance (AC)	5	2.679	.901	.604	.116	.858	.875
Factor	<i>CR</i>	<i>AVE</i>	<i>MSV</i>	<i>MaxR(H)</i>	<i>AV</i>	<i>HA</i>	<i>AC</i>
AV	.954	.805	.062	.962	.897 ^a		
HA	.966	.852	.049	.986	-.221*	.923 ^a	
AC	.859	.553	.062	.887	-.249*	.011	.744 ^a

Notes: ^a= Values on the diagonal represent the square root of Average Variance Extracted; α = Cronbach's α ; ω = McDonald's ω ; *AVE*= Average Variance Extracted; *CR*= Composite Reliability; *MaxR(H)*= Maximum Reliability; *MSV*= Maximum Shared Variance; *= $p < .001$ (two-tailed).

Test-retest reliability was evaluated in a subsample of 50 participants who completed the same questionnaire package again 14 days after the first administration. Pearson correlations indicated high temporal stability for Avoidance ($r = .946, p < .01$), Harnessing ($r = .973, p < .01$), Acceptance ($r = .864, p < .01$), and the total score ($r = .962, p < .01$).

Measurement invariance across gender was examined using multi-group CFA on the full sample. As shown in Table 6, changes in fit indices across configural, metric, scalar, and strict models were small ($\Delta CFI, \Delta TLI, \text{ and } \Delta RMSEA$ values were all below .015), supporting invariance of the T-PPFI across men and women.

Table 6. Model fit statistics and invariance testing across gender ($N = 604$)

Model	χ^2	<i>df</i>	<i>CFI</i>	<i>TLI</i>	<i>RMSEA</i>	Comparison	$\Delta\chi^2(df)$	ΔCFI	ΔTLI	$\Delta RMSEA$
M1: Configural invariance	381.973	166	.973	.965	.046	—	—	—	—	—
M2: Metric invariance	391.845	178	.973	.968	.045	M1	9.872 (12)	.000	.003	.001
M3: Scalar invariance	406.174	193	.973	.971	.043	M2	14.290 (15)	.000	.003	.002
M4: Strict invariance	441.705	208	.970	.970	.043	M3	35.561 (15)	.003	.001	.000

Notes: χ^2 = Chi-square; *df*= Degrees of Freedom; *CFI*= Comparative Fit Index; *TLI*= Tucker-Lewis Index; *RMSEA*= Root Mean Square Error of Approximation; $\Delta\chi^2(df)$ = change in χ^2 ; $\Delta CFI/\Delta TLI/\Delta RMSEA$ = change in Fit Indices.

Convergent and divergent validity with external measures are presented in Table 7. The T-PPFI total score was positively correlated with CompACT ($r = .468, p < .01$) and negatively with AAQ-II ($r = -.380, p < .01$) and DASS-21 ($r = -.380, p < .01$). The T-PPFI subscales showed the same overall pattern of associations with these measures.

Table 7. Correlations of the T-PPFI with other scales ($N = 604$).

Variable	<i>M</i>	<i>SD</i>	α	T-PPFI Total	Avoidance	Harnessing	Acceptance	AAQ-II	CompACT
T-PPFI total score	3.853	.724	.727	1					
Avoidance	2.923	1.354	.956	.455*	1				
Harnessing	5.870	1.680	.967	.705*	-.141*	1			
Acceptance	2.767	.954	.858	.391*	-.134*	.045	1		
AAQ-II	28.233	12.553	.979	-.380*	-.253*	-.199*	-.157*	1	
CompACT	84.039	28.959	.933	.468*	.240*	.308*	.183*	-.922*	1
DASS-21	56.124	14.077	.971	-.380*	-.295*	-.134*	-.211*	.213*	-.247*

Notes: *= $p < .01$ (two-tailed); AAQ-II= Acceptance and Action Questionnaire-II; CompACT= Comprehensive Assessment of Acceptance and Commitment Therapy Processes; DASS-21= Depression Anxiety and Stress Scales-21.

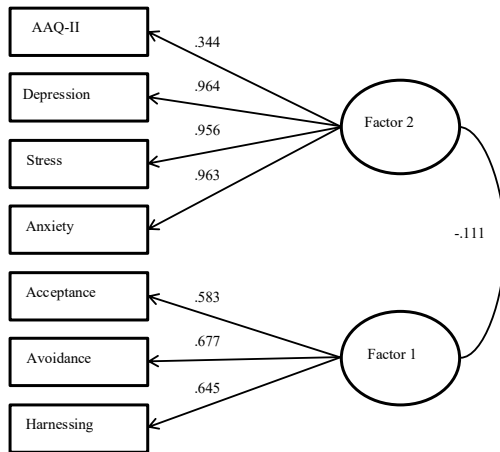


Figure 2. High order EFA results.

Higher-order EFA results are presented in Figure 2. Using subscale mean scores as indicators, the analysis supported a two-factor solution ($KMO= 0.759$; $\chi^2= 2994.316$, $df= 21$, $p < .001$) explaining 62.618% of the variance (Factor1= 45.160%; Factor 2= 17.458%). The three T-PPFI subscales loaded on Factor 1 (Harnessing= 0.645; Avoidance= 0.677; Acceptance= 0.583). DASS-21 subscales and AAQ-II loaded on Factor 2 (Depression= 0.964; Anxiety= 0.963; Stress= 0.956; AAQ-II= 0.344). The correlation between the two higher-order factors was negative ($r= -.111$).

Incremental validity results are reported in Table 8. In hierarchical regression models predicting DASS-21 Depression, Stress, and Anxiety, adding the three T-PPFI subscales after AAQ-II and CompACT produced meaningful increases in explained

Table 8. Incremental validity (hierarchical regression).

Outcome / Step / Predictor	B	SE	β	t	R ²	ΔR^2
DASS-21 Depression (Step 1)						
AAQ-II	-.004*	.006*	-.074	-.728*	.054*	—
CompACT	-.005*	.002*	-.299*	-2.925*		
DASS-21 Depression (Step 2)						
AAQ-II	-.002*	.005*	-.043	-.442*	.179*	.125
CompACT	-.002*	.002*	-.104	-1.021*		
T-PPFI Harnessing	-.058*	.017*	-.144*	-3.512*		
T-PPFI Acceptance	-.165*	.027*	-.231*	-6.019*		
T-PPFI Avoidance	-.166*	.020*	-.330*	-8.256*		
DASS-21 Stress (Step 1)						
AAQ-II	-.005*	.005*	-.094	-.921*	.054*	—
CompACT	-.005*	.002*	-.315*	-3.082*	*	
DASS-21 Stress (Step 2)						
AAQ-II	-.004*	.005*	-.079	-.795*	.155	.101
CompACT	-.003*	.002*	-.158	-1.522*		
T-PPFI Harnessing	-.043*	.017*	-.107*	-2.564*		
T-PPFI Acceptance	-.149*	.027*	-.212*	-5.443*		
T-PPFI Avoidance	-.148*	.020*	-.298*	-7.347*		
DASS-21 Anxiety (Step 1)						
AAQ-II	-.006*	.006*	-.109	-1.076*	.072	—
CompACT	-.007*	.002*	-.365*	-3.600*		
DASS-21 Anxiety (Step 2)						
AAQ-II	-.004*	.005*	-.072	-.744*	.203	.131
CompACT	-.003*	.002*	-.158	-1.570*		
T-PPFI Harnessing	-.065*	.017*	-.156*	-3.842*		
T-PPFI Acceptance	-.176*	.028*	-.240*	-6.324*		
T-PPFI Avoidance	-.174*	.020*	-.335*	-8.499*		

Note: * = $p < .01$

variance ($\Delta R^2 = 0.125$ for Depression, 0.101 for Stress, and 0.131 for Anxiety). In these models, Harnessing, Acceptance, and Avoidance were significant negative predictors of DASS-21 outcomes.

DISCUSSION

The present study examined the psychometric properties of the Turkish version of the Personalized Psychological Flexibility Index (T-PPFI) in disaster search and rescue volunteers who participated in the 2023 Kahramanmaraş earthquakes. Overall, findings supported the use of the 15-item T-PPFI as a reliable and valid measure of psychological flexibility in this population. EFA indicated a three-factor structure (Avoidance, Acceptance, Harnessing), and CFA results showed that the three-factor model fit the data better than alternative one-factor and two-factor models. This pattern aligns with prior studies that have generally supported the three-factor organization of the PPFi across different samples and cultural contexts (Kashdan *et alii*, 2020; Akbari *et alii*, 2021; Fang *et alii*, 2023; Jiang *et alii*, 2024; Xia *et alii*, 2023).

Reliability evidence was also supportive. Internal consistency was acceptable for the total score and high for the subscales, and test-retest correlations over 14 days indicated strong temporal stability. The comparatively high retest coefficients should be interpreted cautiously, as they may be influenced by design features (e.g., short retest interval, self-report format) and by the fact that the PPFi assesses a goal-anchored regulatory capacity that may be more stable than momentary distress.

Validity evidence was consistent with expectations. The T-PPFI total score showed a positive association with a related ACT-process measure (CompACT) and negative associations with psychological inflexibility (AAQ-II) and negative emotional symptoms (DASS-21). In addition, higher-order EFA supported a two-factor structure separating psychological flexibility indicators from negative affect/experiential avoidance indicators, and hierarchical regression analyses showed that T-PPFI subscales explained incremental variance in DASS-21 outcomes beyond AAQ-II and CompACT. Together, these findings suggest that the T-PPFI captures meaningful variance relevant to mental health symptoms while retaining conceptual distinctiveness from measures that primarily reflect distress or inflexibility.

Gender measurement invariance analyses further indicated that the T-PPFI functioned similarly for men and women. This supports the comparability of scores across genders in this sample and strengthens the scale's utility for both research and applied settings where group comparisons may be needed.

Several limitations should be considered when interpreting these findings. First, data were collected between 03.03.2025 and 14.04.2025, approximately 26 months after the earthquakes. Over this period, participants may have experienced recovery processes, subsequent stressors, changes in occupational roles, social support, or psychological interventions, all of which could influence psychological flexibility and symptom levels. Because the study did not include a specific measure of current earthquake-related distress, exposure severity, or treatment history, conclusions should be limited to the constructs measured during the assessment window. Second, the sample was obtained via convenience sampling and consisted only of AFAD volunteers; therefore, generalizability to other responder groups and settings may be limited. Third, although Turkish versions of the comparator measures have been published, we used *de novo* translations to ensure consistent terminology and administration across the full questionnaire battery for this specific target group. Future studies should replicate convergent/divergent validity findings

using previously validated Turkish forms and examine the equivalence of results across versions. Finally, as the study was cross-sectional, longitudinal research is needed to evaluate predictive validity and sensitivity to change over time.

Despite these limitations, the T-PPFI may be useful for disaster mental health research and practice. Because the measure is anchored to a personally meaningful, work-related goal, it can provide actionable information about goal-consistent functioning under distress. The scale may support needs assessment, monitoring of training outcomes, and identification of individuals who may benefit from targeted psychosocial support. In sum, the findings indicate that the Turkish adaptation of the PPFİ yields psychometrically adequate scores and represents a promising tool for assessing psychological flexibility in Turkish disaster search and rescue volunteers.

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