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Psychometric Properties of the Taiwanese Translation of the Multidimensional Assessment of Interoceptive Awareness, Version 2 (MAIA-2)

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Research Article

Keywords: interoception, interoceptive awareness, interoceptive sensibility, psychometric properties, MAIA-2

Posted Date: September 14th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-10600059/v1

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Additional Declarations: No competing interests reported.

Abstract

Background

Interoceptive sensibility, defined as individuals' tendency to consciously notice, attend to, interpret, and utilize bodily sensations, has increasingly been recognized as a transdiagnostic factor in psychopathology. The Multidimensional Assessment of Interoceptive Awareness, Version 2 (MAIA-2) is a widely used measurement of interoceptive sensibility. This study aims to examine the psychometric properties of Taiwanese translation of MAIA-2.

Methods

A total of 618 online questionnaires were collected. Following a five-stage data quality screening procedure, final sample comprised 429 participants (280 females) with a mean age 33.40 ± 5.26 years. Internal consistency (the McDonald's ω), test-retest reliability (intraclass correlation coefficient, [ICC]), exploratory factor analysis (EFA), confirmatory factor analysis (CFA), and construct validity (Pearson's *r*) were explored. Participants were randomly divided into two independent subsamples for EFA (n = 214) and CFA (n = 215). Construct validity measures included Taiwanese Version of the Five Facet Mindfulness Questionnaire, Difficulties in Emotion Regulation Scale–16, Toronto Alexithymia Scale, Depression, Anxiety, Stress Scale–21, and Perth emotional reactivity scale–short form.

Results

The McDonald's ω was .93 for the MAIA-2 total, with subscale coefficients ranging from .68 to .91. The ICC for total scale was .88, with subscale coefficients ranging from .62 to .85. The EFA yielded a five-factor solution after deleting four items, accounting for 56.4% of the total variance. CFA indicated that the modified eight-factor model (with four items removed) demonstrated a better fit than original eight-factor model and five-factor model (△CFI = .048 & .042, respectively). Overall, the construct validity was supported; however, surprising findings were observed for Not-Distracting subscale in relation to the Nonreactivity (mindfulness subscale) and for the hypotheses regarding ease of activation of negative emotion.

Conclusions

The Taiwanese version of the MAIA-2 demonstrated good psychometric properties. The original eight-factor structure appeared to be generally stable across cultures, although minor modifications may improve model fit. Consistent to prior research, the Noticing, Not-Distracting, and Not-Worrying subscales demonstrated comparatively weaker performance. In addition, the findings suggest a possible tendency toward overgeneralization in the Taiwanese sample, warranting further investigation.

Background

In recent years, an increasing number of theoretical models and empirical studies have supported the notion that different psychiatric disorders share common underlying psychopathological factors, leading to the emergence of a transdiagnostic approach to psychopathology. The transdiagnostic perspective seeks to integrate fundamental psychological processes, comorbidity patterns, symptom structures, and developmental trajectories of psychological distress across the lifespan in order to identify common mechanisms that play important roles across multiple disorders and thereby improve the efficiency of intervention efforts (1). For example, selective attention, over-general autobiographical memory, repetitive negative thinking, emotion regulation, experiential avoidance, circadian rhythm dysregulation, abnormalities in reward-related neural circuitry, and disrupted functional connectivity have all been proposed as important transdiagnostic psychophysiological processes (1–4).

Interoceptive sensibility has increasingly attracted attention as a transdiagnostic factor in psychopathology research. Interoceptive sensibility refers to an individual's subjective tendency to notice, attend to, interpret, and utilize bodily sensations (5, 6). According to the evolutionary-functional perspective on emotion, emotions consist of coordinated responses to internal and external environmental stimuli, including physiological reactions, cognitive appraisals, subjective experiences, communicative behaviors, and action tendencies. The degree of coherence among these components is closely related to adaptive functioning (7, 8). Building on this perspective, researchers have proposed that how individuals process bodily sensations influences the coherence among emotional physiological responses, subjective emotional experiences, and subsequent behaviors, thereby affecting emotional functioning (9, 10). Empirical evidence has demonstrated that greater interoceptive sensibility is associated with better emotion identification and emotional awareness, more adaptive use of emotion regulation strategies, and overall psychological adaptation (5, 11–13). It has also been linked to lower levels of emotion dysregulation, alexithymia, and suicidal ideation (6, 14, 15). However, higher interoceptive sensibility has also been associated with alcohol use disorder (16) and greater body-related impulsivity (17). More complex findings suggest that interoceptive sensibility is not merely linearly associated with adaptive outcomes, but may also play moderating role on the relationships among different emotional components (18), between physiological responses and behavioral decision-making (19), and the differential psychopathological mechanisms of insomnia (20). Collectively, these findings suggest that interoceptive sensibility may play multiple and potentially distinct roles across different forms of psychopathology, warranting further investigation.

How individuals processing bodily sensations has long been a topic of interest in psychological research. However, for many years, the field lacked an integrated conceptual framework. Numerous constructs have been proposed to capture this phenomenon, including body awareness, somatic awareness, and interoceptive awareness, yet these concepts often lacked clear definitions and boundaries (5, 10). To address this issue, Mehling, Price (5) synthesized previous literature and proposed that research on awareness of bodily sensations encompasses several interrelated processes, and developed the Multidimensional Assessment of Interoceptive Awareness (MAIA) to measure such processes. Later psychometric studies indicated insufficient internal consistency for two subscales, prompting revision of the instrument and resulting in the Multidimensional Assessment of Interoceptive Awareness, Version 2 (MAIA-2) (6). Prior to the publication of MAIA-2, researchers further refined the conceptualization of interoceptive awareness, and re-defined the process MAIA assessed as “interoceptive sensibility” rather than previous naming “interoceptive awareness” (10). Accordingly, Mehling, Acree (6) emphasized that although the instrument retained the term "interoceptive awareness" in its title for continuity with the original version, the measure actually assessed “interoceptive sensibility”.

The MAIA-2 comprises eight subscales, each assessing a distinct dimension of interoceptive sensibility: (1) Noticing, the tendency to notice various bodily sensations; (2) Not-Distracting, the tendency not to distract oneself from unpleasant bodily sensations; (3) Not-Worrying, the tendency not to worry about unpleasant bodily sensations; (4) Attention Regulation, the ability to sustain and intentionally direct attention toward bodily sensations; (5) Emotional Awareness, awareness of the relationship between bodily sensations and emotional experiences; (6) Self-Regulation, the ability to regulate distress through attention to bodily sensations; (7) Body Listening, the tendency to actively listen to bodily sensations for insight; and (8) Trusting, the tendency to experience one's body as safe and trustworthy. A total score reflects overall interoceptive sensibility (6).

At the time MAIA-2 was introduced, the original MAIA had already been translated into 20 languages and was being widely used internationally (6), including Taiwan. Lin, Hsu (21) translated and validated the original MAIA in Taiwan. Their findings indicated that, with the exception of the Noticing (α = .76), Not-Distracting (α = .58), and Not-Worrying (α = .46) subscales, all other subscales demonstrated internal consistency coefficients above .80. Furthermore, the original eight-factor structure showed acceptable model fit (RMSEA = .076, CFI = .95), suggesting that the MAIA was generally applicable to Taiwanese samples.

To date, the psychometric properties of MAIA-2 has been examined in countries including the Netherlands, Turkey, Peru, Lebanon, Italy, Norway, Iran, Colombia, France, and China (22–31). Psychometric evaluations have also been conducted in specific populations, including hospitalized patients with depression (32), pregnant women (33), dermatology outpatients (34),

and transgender and gender-diverse individuals (35). Across studies conducted in community adult samples from different cultural and linguistic backgrounds, the MAIA-2 has generally demonstrated acceptable to good psychometric properties. Evidence supports satisfactory internal consistency (22, 24–30), test-retest reliability (22, 26, 30), factorial validity (6, 24–30) and construct validity (25–30). Nevertheless, several studies have reported relatively weaker performance for the Noticing (22, 26, 28, 30), Not-Distracting (29, 30) and Not-Worrying (6, 24, 29, 30) subscales, including lower internal consistency and/or weaker factor loadings. Moreover, several alternative factor structures have been proposed (22–27, 31). These findings suggest that although the MAIA-2 demonstrates cross-cultural stability in general, variation remains in the performance of specific subscales and in its latent structure.

The present study aimed to examine the psychometric properties of a Taiwanese version of the MAIA-2, including internal consistency, test-retest reliability, factorial validity, and construct validity. For construct validity, we selected theoretically relevant constructs that have been reported in previous MAIA and MAIA-2 research, or inferred by research of interoceptive sensibility. The hypothesized relationships between the constructs and each MAIA-2 subscale are described in detail in the Construct Validity section of the Method.

Method

Translation of MAIA-2

The MAIA-2 was translated using a five-stage procedure consisting of translation, readability revision, back-translation, comparison of the Mandarin and English versions, and final consensus revision. Except for the readability revision stage, all professionals involved in the translation process were native Mandarin speakers who were raised in Taiwan, were proficient in academic English in psychology, and had authored at least one English-language scholarly article in the field of psychology. First, the author, who was familiar with the concept of interoceptive sensibility, translated the MAIA-2 into Mandarin based on the Taiwanese translation of the original MAIA (21). Second, the translated version was reviewed with an undergraduate student to evaluate readability and comprehensibility, and revisions were made accordingly. Third, a master's-level psychologist independently back-translated the questionnaire into English. The back-translated version was then compared with the original English version by a doctoral-level psychologist, and potentially problematic items were identified. Finally, an additional doctoral-level psychologist was invited, and all five individuals collaboratively discussed and revised the questionnaire until consensus was reached.

Procedure

Participants were recruited through online platforms. Individuals who read and agreed to the informed consent form were directed to complete the questionnaires by Google forms.

Completion of the baseline survey required approximately 20 to 30 minutes. Participants who completed the survey and provided their email received an electronic gift voucher worth NTD$100 (about USD$3.14). A follow-up assessment was conducted one month later by sending participants who had agreed to be recontacted a link containing the MAIA-2 questionnaire and another questionnaire which is irrelevant to this study. The follow-up survey required approximately 10 to 15 minutes to complete. Participants who completed the re-test received an additional NTD$50 electronic gift voucher. In addition, to improve the quality of the online survey data, four bogus items were embedded throughout the questionnaire and were used as indicators of response validity.

Response Quality Screening

A total of 618 online questionnaires were collected. After a five-stage data quality control procedure, 429 valid responses were retained. The invalid rate was 30.6%. In the first stage, one questionnaire containing entirely blank data due to a system error was removed. In the second stage, five questionnaires with missing data caused by an incorrect survey setting during the early phase of data collection were excluded. The third stage involved screening based on the four bogus items. First, participants who answered “Agree” to the statement "I answered this questionnaire randomly" (response options:

Agree/Disagree) were excluded (n = 40). Second, participants who responded "Not at all," "Rarely," or "Occasionally" to the statement "I answered this questionnaire seriously" in a 5-point Likert's scale were excluded (n = 79). Third, participants who responded "Almost always," "Most of the time," or "About half of the time" to the statement "I cannot understand Mandarin" in a 5-point Likert's scale were excluded (n = 13). Fourth, participants who responded "Disagree," "Neutral," or "Strongly disagree" to the statement "I am not a robot" in a 5-point Likert's scale were excluded (n = 19). In the fourth stage, the remaining responses were manually inspected. One participant who entered a mobile phone number in the age field was excluded. Two participants who provided obviously invalid email addresses were removed. Four participants with duplicate email addresses and highly similar completion times were excluded. Six additional cases with highly similar completion times, email addresses, names, and response patterns were removed. Finally, two questionnaires completed at the same time and containing nearly identical responses except for name, gender, age, and one questionnaire item were excluded. In the fifth stage, 19 participants older than 40 years were excluded according to the inclusion and exclusion criteria.

Participants

Participants were eligible if they were between 18 and 40 years of age. Exclusion criteria included self-reported diagnoses of psychiatric disorders, chronic physical illnesses, and substance misuse. After data screening, the final sample consisted of 429 participants, with a mean age of 33.40 years (SD = 5.16), including 280 females (65.3%). To avoid conducting exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) on the same sample, participants were randomly divided into two independent subsamples. One subsample of 214 participants was used for the EFA, and the remaining 215 participants were used for the CFA. Because the MAIA-2 contains 37 items, the sample size recommendations proposed by Kyriazos (2018) suggest that the required sample size should range from five to ten times the number of items (N = 185–370).

For the test–retest reliability, 341 participants completed the follow-up assessment. Their responses were matched with the baseline valid data using three identifiers: name, email address, and gender. A total of 172 participants could be unequivocally matched to their baseline responses, and manual inspection revealed no additional concerns regarding data quality. These participants had a mean age of 34.05 years (SD = 4.87), and 109 were women (63.4%).

Measurements

Multidimentional Assessement of Interoceptive Awareness, version 2, MAIA-2

The MAIA-2 (6) assesses multiple psychological processes involved in the detection, interpretation, and utilization of internal bodily sensations. The instrument contains 37 items rated on a 6-point Likert scale ranging from 0 (Never) to 5 (Always). Scores for each subscale are calculated by averaging the corresponding item scores, and total score is the sum of scores from all subscales. The instrument comprises eight subscales: (1) Noticing, the tendency to notice various bodily sensations; (2) Not-Distracting, the tendency not to distract oneself from unpleasant bodily sensations; (3) Not-Worrying, the tendency not to worry about unpleasant bodily sensations; (4) Attention Regulation, the ability to sustain and restore attention to bodily sensations; (5) Emotional Awareness, awareness of the relationship between bodily sensations and emotional experiences; (6) Self-Regulation, the ability to regulate distress through attention to bodily sensations; (7) Body Listening, the tendency to actively listen to bodily sensations for insight; and (8) Trusting, the tendency to experience one's body as safe and trustworthy. A total score reflects overall interoceptive sensibility. The original MAIA-2 demonstrated Cronbach's alpha coefficients ranging from .64 to .83, as well as satisfactory factor structure stability (6) and construct validity (31).

Taiwanese Version of the Five Facet Mindfulness Questionnaire, T-FFMQ

The Taiwanese Version of the Five Facet Mindfulness Questionnaire (36) is the Taiwanese adaptation of the widely used Five Facet Mindfulness Questionnaire (37). The T-FFMQ contains 39 items rated on a 5-point Likert scale ranging from 1 (Never or very rarely true) to 5 (Very often or always true). The questionnaire comprises five subscales: Observing, Describing, Acting with Awareness, Nonjudging (of inner experience), and Nonreactivity (to inner experience). Higher scores indicate greater

levels of mindfulness. Internal consistency coefficients of the subscales range from .74 to .88, with an alpha coefficient of .88 for the total scale and a two-week test–retest reliability coefficient of .95. Evidence also supports acceptable criterion validity and factor structure stability, although the Nonjudging subscale has demonstrated relatively weaker psychometric performance.

Difficulties in Emotion Regulation Scale – 16, DERS-16

The Difficulties in Emotion Regulation – 16 (38) is a short form of the original Difficulties in Emotion Regulation Scale (39). It contains 16 items rated on a 5-point Likert scale ranging from 1 (Almost never) to 5 (Almost always). The instrument comprises five subscales: Lack of Emotional Clarity, Difficulties Engaging in Goal-Directed Behavior, Impulse Control Difficulties, Limited Access to Effective Emotion Regulation Strategies, and Nonacceptance of Emotional Responses. Higher scores indicate greater difficulties in emotion regulation. The DERS-16 has demonstrated satisfactory internal consistency, test–retest reliability, factor structure stability, construct validity, and criterion validity, with correlations with external criteria nearly identical to those of the original 36-item version (38).

Toronto Alexithymia Scale, TAS

The Toronto Alexithymia Scale (40) measures difficulties in emotional awareness and expression. The scale contains 20 items rated on a 5-point Likert scale ranging from 1 (Strongly disagree) to 5 (Strongly agree). The three subscales assess Difficulty Identifying Feelings, Difficulty Describing Feelings, and Externally Oriented Thinking. Higher scores indicate greater alexithymia. In addition, Bagby, Parker (40) indicated that although the TAS comprises with 3 subscales, it is suggested to treat TAS as one construct (i.e., using total score) rather than examine differential effects of subscales The TAS has demonstrated satisfactory internal consistency, test–retest reliability, construct validity, and criterion validity (41–43). Studies using Taiwanese samples have also supported its internal consistency and factor structure (44)

Depression, Anxiety, Stress Scale – 21, DASS-21

The Depression Anxiety Stress Scales–21 (45) is widely used internationally and has an official Mandarin version for use in Taiwan (46). The scale consists of 21 items rated on a 4-point Likert scale ranging from 0 (Did not apply to me at all) to 3 (Applied to me very much or most of the time). The three subscales assess the severity of Depressive symptoms, Anxiety symptoms, and Stress level during the previous week. Higher scores indicate greater symptom severity. Review studies have demonstrated strong evidence for its internal consistency, factor structure stability, criterion validity, and construct validity (47).

Perth emotional reactivity scale - short form, PERS-S

The Perth Emotional Reactivity Scale–Short Form (48) is a brief version of the original PERS (49) which was developed based on Davidson's (50) conceptualization of emotional reactivity. The PERS assesses trait-level emotional reactivity in terms of the threshold, intensity, and duration of emotional responses to both positive and negative affect. The PERS-S consists of two higher-order scales: General Positive Reactivity (PERS-GPR) and General Negative Reactivity (PERS-GNR). Each scale comprises three lower-order subscales: Ease of Activation, Intensity, and Duration, yielding a six-factor structure. The instrument contains 18 items rated on a 5-point Likert scale ranging from 1 (Very unlike me) to 5 (Very like me). Higher scores indicate greater emotional reactivity in the corresponding dimension. The PERS-S has demonstrated satisfactory internal consistency and construct validity (48).

Construct Validity Hypotheses

Based on the original MAIA development study (5), previous studies examining the construct validity of the MAIA and MAIA-2, and theories proposed in relevant research, the expected associations between the eight MAIA-2 subscales and related

constructs were hypothesized as follows.

The Noticing subscale was expected to be positively correlated with the T-FFMQ Observing subscale because both constructs involve the tendency to attend to one's internal experiences (5). Individuals who are more likely to notice bodily sensations may also be more readily emotionally activated; therefore, Noticing was hypothesized to be positively associated with the Ease of Activation subscales of the PERS-S for both positive and negative emotional reactivity (48).

The Not-Distracting subscale reflects a coping style toward bodily sensations and conceptually overlaps with the Nonreactivity subscale of the T-FFMQ, as both involve refraining from disengaging from internal experiences. Therefore, a positive association was expected. Because Not-Distracting also reflects the ability to sustain observation of ongoing experiences, a weak positive correlation with the Observing subscale of the T-FFMQ was also expected. In addition, because Not-Distracting involves maintaining attention on ongoing activities, it was hypothesized to be weakly negatively associated with the Difficulties Engaging in Goal-Directed Behavior subscale of the DERS-16 (5).

The Not-Worrying subscale similarly represents a coping response to bodily sensations and was expected to be positively associated with the Nonreactivity subscale of the T-FFMQ. Because worrying about bodily sensations is closely related to anxiety processes, Not-Worrying was hypothesized to be negatively correlated with the Anxiety subscale of the DASS-21. Furthermore, because concerns about bodily sensations have been associated with greater emotion regulation difficulties, negative associations with the DERS-16 subscales were also expected (5).

The Attention Regulation subscale assesses the ability to sustain and control attention toward bodily sensations and therefore overlaps conceptually with the Acting with Awareness, Observing, and Nonreactivity subscales of the T-FFMQ. Positive associations with these mindfulness dimensions were therefore expected. Because attention regulation involves the capacity to maintain focus on ongoing tasks, a weak negative association with Difficulties Engaging in Goal-Directed Behavior was hypothesized (5).

The Emotional Awareness subscale assesses the ability to use bodily sensations to understand one's emotional experiences and therefore involves processes similar to the Observing and Describing facets of mindfulness. Accordingly, positive associations with these subscales were expected. Because Emotional Awareness represents the opposite of difficulties in identifying one's emotional experiences, negative associations with alexithymia (TAS) and Nonacceptance of Emotional Responses were also hypothesized (5, 15).

The Self-Regulation subscale assesses the ability to regulate emotions through attention to bodily sensations and therefore overlaps with the Acting with Awareness and Nonreactivity facets of mindfulness. Positive associations with these subscales were expected. Deficits in self-regulation are also associated with emotion regulation difficulties and subsequently emotional disturbances; consequently, negative correlations with the DERS-16 subscales and with the Duration of negative emotional reactivity on the PERS-S, DASS-21 were hypothesized (6, 48).

The Body Listening subscale measures the tendency to actively listen to bodily sensations to gain insight and conceptually overlaps with the Observing, Acting with Awareness, and Nonreactivity subscales of the T-FFMQ. Positive associations with these mindfulness dimensions were therefore expected. Because attending to bodily sensations may increase awareness of emotional responses and lower the threshold for emotional activation, positive correlations with the Ease of Activation (Act) subscales of both positive and negative emotional reactivity were also hypothesized(49). Furthermore, the absence of this process may contribute to difficulties in emotional awareness and emotion regulation; therefore, negative associations with alexithymia (TAS) and the DERS-16 subscales were expected (5, 15).

Finally, the Trusting subscale assesses the extent to which individuals experience their bodies as safe and trustworthy, reflecting a positive orientation toward bodily sensations. Therefore, a positive association with the Nonreactivity subscale of the T-FFMQ and a negative association with Nonacceptance of Emotional Responses of the DERS-16 were hypothesized. Because lower levels of bodily trust may be associated with persistent anxiety, Trusting was also expected to be negatively correlated with DASS-21 Anxiety (5).

Statistical Analysis

All statistical analyses were conducted using JASP version 0.98.0 (51). Internal consistency was evaluated using McDonald's ω (52). Test–retest reliability was assessed using both Pearson correlations and intraclass correlation coefficients (ICC) (53). Construct validity was examined using Pearson correlation analyses. Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity was used to evaluate data suitability for factor analysis. EFA was then conducted using principal axis factoring with oblimin rotation. The number of factors to retain was determined using parallel analysis based on factor analysis eigenvalues (54). The original eight-factor model of the MAIA-2 and factor structure extracted from the EFA sample was examined by CFA. Because the MAIA-2 uses Likert-type response scales and therefore produces ordinal data, CFA was performed using the diagonal weighted least squares mean- and variance-adjusted (WLSMV) estimator, which is recommended for ordinal indicators (55). Model fit was evaluated using the comparative fit index (CFI), Tucker–Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR) (56, 57).

Results

Internal Consistency

The McDonald's ω for the MAIA-2 total was .93, with subscale coefficients ranging from .68 to .91 (Table 1).

Test–Retest Reliability

The Pearson's coefficient for the MAIA-2 total score was .79. Pearson coefficients between baseline and follow-up assessments for the eight subscales ranged from .45 to .75, all reaching statistical significance (all ps < .001; Table 1). The ICC for MAIA-2 total was .88 (95% LLCI – ULCI = .83 – .91). The ICCs and their 95% confidence intervals (CI) for each subscale are presented in Table 1.

Table 1
Internal Consistency and Test-retest coefficients for subscales of MAIA-2

Noticing	***ω***	***r***	**ICC**	**95% LLCI for ICC**	**95% ULCI for ICC**
	.68	**.45**	**.62**	**.48**	**.72**
Not-Distracting	.78	.55	.71	.61	.79
Not-Worrying	.69	.55	.71	.60	.78
Attention Regulation	.90	.75	.84	.78	.88
Emotional Awareness	.87	.48	.64	.51	.73
Self-Regulation	.91	.74	.85	.80	.89
Body Listening	.89	.67	.80	.73	.85
Trusting	.91	.64	.78	.70	.84
MAIA-2 total	.93	.79	.88	.83	.91

Differences Between EFA and CFA Samples

The EFA subsample consisted of 214 participants with a mean age of 33.47 years (SD = 4.96; range = 20–40 years), including 138 women (64.5%). The CFA subsample consisted of 215 participants with a mean age of 33.34 years (SD = 5.35; range = 19–40 years), including 142 women (66.0%). No significant differences were found between the two subsamples in gender distribution (χ^2 = 0.12, p = .734), age (t(427) = 0.27, p = .791), or MAIA-2 total score (t(427) = 1.29, p = .197). A significant difference was observed for the Attention Regulation subscale (t(427) = 2.42, p = .025), with the EFA group showing higher scores (M = 3.06) than the CFA group (M = 2.85). No significant differences were found for the remaining subscales.

Exploratory Factor Analysis

The data were suitable for factor analysis, as indicated by a KMO measure of .92 and a significant Bartlett's test of sphericity, $\chi^2(666) = 5674.12$, $p = .001$. The EFA results indicated that a five-factor solution provided the best fit. The extracted factors contained 4 to 13 items (Table 2). Three items (items 5, 15, and 17) showed factor loadings below .40, whereas item 11 demonstrated factor loadings above .40 on both Factor 3 and Factor 4. Parallel analysis indicated that a five-factor solution was the most appropriate solution. The five extracted factors explained 56.4% of the total variance. As presented in Table 3, after oblimin rotation, Factor 1 accounted for 20.7% of the variance, followed by Factor 2 (13.1%), Factor 3 (7.7%), Factor 4 (7.6%), and Factor 5 (7.2%). The highest correlation between factors was .654 (Table 4), supporting the use of oblique rotation.

Table 2
Factor loadings of MAIA-2 items

1. When I am tense I notice where the tension is located in my body.	**Factor 1**	**Factor 2**	**Factor 3**	**Factor 4**	**Factor 5**	**Uniqueness**
			0.582			**0.623**
2. I notice when I am uncomfortable in my body.			0.651			0.570
3. I notice where in my body I am comfortable.			0.473			0.441
4. I notice changes in my breathing, such as whether it slows down or speeds up.			0.560			0.537
5. I ignore physical tension or discomfort until they become more severe.						0.863
6. I distract myself from sensations of discomfort.					0.526	0.519
7. When I feel pain or discomfort, I try to power through it.					0.439	0.702
8. I try to ignore pain.					0.695	0.499
9. I push feelings of discomfort away by focusing on something.					0.804	0.303
10. When I feel unpleasant body sensations, I occupy myself with something else so I don't have to feel them.					0.837	0.302
11. When I feel physical pain, I become upset.			0.411	-0.407		0.587
12. I start to worry that something is wrong if I feel any discomfort.				-0.519		0.554
13. I can notice an unpleasant body sensation without worrying about it.				0.597		0.554
14. I can stay calm and not worry when I have feelings of discomfort or pain.				0.598		0.363
15. When I am in discomfort or pain I can't get it out of my mind						0.825
16. I can pay attention to my breath without being distracted by things happening around me.				0.502		0.442
17. I can maintain awareness of my inner bodily sensations even when there is a lot going on around me.						0.477
18. When I am in conversation with someone, I can pay attention to my posture.		0.530				0.620
19. I can return awareness to my body if I am distracted.		0.660				0.377
20. I can refocus my attention from thinking to sensing my body.		0.720				0.306
21. I can maintain awareness of my whole body even when a part of me is in pain or discomfort.		0.795				0.319
22. I am able to consciously focus on my body as a whole.		0.816				0.304
23. I notice how my body changes when I am angry.		0.550				0.454

1. When I am tense I notice where the tension is located in my body.	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Uniqueness
			0.582			**0.623**
24. When something is wrong in my life I can feel it in my body.		0.524				0.557
25. I notice that my body feels different after a peaceful experience.	0.560					0.351
26. I notice that my breathing becomes free and easy when I feel comfortable.	0.571					0.383
27. I notice how my body changes when I feel happy / joyful.	0.584					0.297
28. When I feel overwhelmed I can find a calm place inside.	0.497					0.292
29. When I bring awareness to my body I feel a sense of calm.	0.627					0.243
30. I can use my breath to reduce tension.	0.587					0.340
31. When I am caught up in thoughts, I can calm my mind by focusing on my body/breathing.	0.713					0.286
32. I listen for information from my body about my emotional state.	0.721					0.330
33. When I am upset, I take time to explore how my body feels.	0.907					0.215
34. I listen to my body to inform me about what to do.	0.854					0.238
35. I am at home in my body.	0.685					0.312
36. I feel my body is a safe place.	0.735					0.310
37. I trust my body sensations.	0.543					0.429

Table 3
Eigenvalues of Extracted Factors by EFA

	Unrotated solution			Rotated solution		
	Eigenvalue	**Proportion var.**	**Cumulative**	**SumSq. Loadings**	**Proportion var.**	**Cumulative**
Factor 1	13.177	0.356	0.356	7.677	0.207	0.207
Factor 2	3.162	0.085	0.442	4.853	0.131	0.339
Factor 3	2.297	0.062	0.504	2.861	0.077	0.416
Factor 4	1.321	0.036	0.539	2.830	0.076	0.492
Factor 5	0.921	0.025	0.564	2.656	0.072	0.564

Table 4
Correlations of Extracted Factors by EFA

Factor 1	**Factor 1**	**Factor 2**	**Factor 3**	**Factor 4**	**Factor 5**
	-	**0.654**	**0.312**	**0.360**	**0.126**
Factor 2	0.654	-	0.241	0.238	0.176
Factor 3	0.312	0.241	-	-0.075	0.072
Factor 4	0.360	0.238	-0.075	-	-0.031
Factor 5	0.126	0.176	0.072	-0.031	-

Confirmatory Factor Analysis

1. Original Eight-Factor Structure of the MAIA-2

The data were suitable for factor analysis, as indicated by a KMO measure of .91 and a significant Bartlett's test of sphericity, $\chi^2(666) = 5184.00$, $p < .001$. CFA results showed that the original eight-factor model yielded $\chi^2(601) = 922.52$, $p < .001$, CFI = .842, TLI = .824, RMSEA = .049 (95% CI = .043–.055), and SRMR = .093. Factor loadings for individual items are presented in Table 5.

2. Five-Factor Structure Extracted From the EFA

After removing item 5, 15, 11 and 17 that could not be appropriately assigned to the extracted factors, CFA was conducted on the remaining 33 items. The KMO value was .91, and Bartlett's test of sphericity was significant, $\chi^2(528) = 4637$, $p < .001$. The five-factor model extracted from the EFA yielded $\chi^2(485) = 771.72$, $p < .001$, CFI = .848, TLI = .835, RMSEA = .051 (95% CI = .045–.058), and SRMR = .089. Factor loadings are presented in Table 6.

3. Modified Eight-Factor Structure: Removing the Four Items same as EFA

Considering the reduced number of items, the original eight-factor structure was further examined using CFA after removing the same four items identified in the EFA. CFA results indicated that the modified eight-factor model yielded $\chi^2(467) = 674.60$, $p < .001$, CFI = .890, TLI = .876, RMSEA = .045 (95% CI = .037–.052), and SRMR = .077. Factor loadings are presented in Table 7.

Table 5
Factor Loadings on Original Eight-Factor Structure

Factor	Indicator	Std. estimate	Std. Error	*z*-value	*p*	95% LLCI	95% ULCI
Noticing	1. When I am tense I notice where the tension is located in my body.	0.240	0.034	7.12	< .001	0.174	0.306
	2. I notice when I am uncomfortable in my body.	0.255	0.034	7.57	< .001	0.189	0.321
	3. I notice where in my body I am comfortable.	0.798	0.063	12.68	< .001	0.675	0.921
	4. I notice changes in my breathing, such as whether it slows down or speeds up.	0.702	0.056	12.51	< .001	0.592	0.812
Not-Distracting	5. I ignore physical tension or discomfort until they become more severe.	-0.009	0.047	-0.19	.853	-0.100	0.083
	6. I distract myself from sensations of discomfort.	0.595	0.063	9.44	< .001	0.472	0.719
	7. When I feel pain or discomfort, I try to power through it.	0.694	0.068	10.16	< .001	0.560	0.828
	8. I try to ignore pain.	0.369	0.052	7.06	< .001	0.266	0.471
	9. I push feelings of discomfort away by focusing on something.	0.860	0.081	10.61	< .001	0.701	1.019
	10. When I feel unpleasant body sensations, I occupy myself with something else so I don't have to feel them.	0.606	0.064	9.46	< .001	0.481	0.732
Not-Worrying	11. When I feel physical pain, I become upset.	0.121	0.034	3.56	< .001	0.054	0.187
	12. I start to worry that something is wrong if I feel any discomfort.	0.003	0.032	0.10	.921	-0.059	0.066
	13. I can notice an unpleasant body sensation without worrying about it.	-0.733	0.052	-14.22	< .001	-0.833	-0.632
	14. I can stay calm and not worry when I have feelings of discomfort or pain.	-0.904	0.063	-14.41	< .001	-1.027	-0.781
	15. When I am in discomfort or pain I can't get it out of my mind	0.093	0.033	2.84	.005	0.029	0.156
Attention Regulation	16. I can pay attention to my breath without being distracted by things happening around me.	0.773	0.040	19.33	< .001	0.695	0.852
	17. I can maintain awareness of my inner bodily sensations even when there is a lot going on around me.	0.799	0.043	18.79	< .001	0.716	0.883
	18. When I am in conversation with someone, I can pay attention to my posture.	0.661	0.038	17.43	< .001	0.587	0.736
	19. I can return awareness to my body if I am distracted.	0.823	0.044	18.84	< .001	0.737	0.908
	20. I can refocus my attention from thinking to sensing my body.	0.812	0.040	20.18	< .001	0.733	0.891

Factor	Indicator	Std. estimate	Std. Error	*z*-value	*p*	95% LLCI	95% ULCI
	21. I can maintain awareness of my whole body even when a part of me is in pain or discomfort.	0.735	0.037	19.80	< .001	0.662	0.807
	22. I am able to consciously focus on my body as a whole.	0.727	0.038	19.20	< .001	0.653	0.802
Emotional Awareness	23. I notice how my body changes when I am angry.	0.757	0.045	16.83	< .001	0.669	0.845
	24. When something is wrong in my life I can feel it in my body.	0.547	0.043	12.71	< .001	0.463	0.632
	25. I notice that my body feels different after a peaceful experience.	0.766	0.052	14.82	< .001	0.664	0.867
	26. I notice that my breathing becomes free and easy when I feel comfortable.	0.730	0.051	14.43	< .001	0.631	0.829
	27. I notice how my body changes when I feel happy / joyful.	0.805	0.052	15.63	< .001	0.705	0.906
Self-Regulation	28. When I feel overwhelmed I can find a calm place inside.	0.842	0.045	18.69	< .001	0.754	0.930
	29. When I bring awareness to my body I feel a sense of calm.	0.876	0.050	17.40	< .001	0.777	0.975
	30. I can use my breath to reduce tension.	0.750	0.043	17.48	< .001	0.666	0.834
	31. When I am caught up in thoughts, I can calm my mind by focusing on my body/breathing.	0.831	0.046	18.22	< .001	0.741	0.920
Body Listening	32. I listen for information from my body about my emotional state.	0.860	0.053	16.15	< .001	0.756	0.964
	33. When I am upset, I take time to explore how my body feels.	0.771	0.047	16.27	< .001	0.678	0.864
	34. I listen to my body to inform me about what to do.	0.854	0.050	16.98	< .001	0.756	0.953
Trusting	35. I am at home in my body.	0.896	0.052	17.19	< .001	0.794	0.998
	36. I feel my body is a safe place.	0.877	0.054	16.19	< .001	0.771	0.983
	37. I trust my body sensations.	0.807	0.056	14.40	< .001	0.697	0.917

Table 6
Factor Loadings on Five-Factor Structure Extracted From the EFA

Factor	Indicator	Std. estimate	Std. Error	*z*-value	*p*	95% LLCI	95% ULCI
Factor 1	25. I notice that my body feels different after a peaceful experience.	0.650	0.042	15.43	< .001	0.568	0.733
	26. I notice that my breathing becomes free and easy when I feel comfortable.	0.623	0.042	14.90	< .001	0.541	0.705
	27. I notice how my body changes when I feel happy / joyful.	0.691	0.042	16.33	< .001	0.608	0.774
	28. When I feel overwhelmed I can find a calm place inside.	0.777	0.039	19.74	< .001	0.700	0.854
	29. When I bring awareness to my body I feel a sense of calm.	0.814	0.045	18.22	< .001	0.726	0.901
	30. I can use my breath to reduce tension.	0.698	0.038	18.25	< .001	0.623	0.773
	31. When I am caught up in thoughts, I can calm my mind by focusing on my body/breathing.	0.765	0.040	19.15	< .001	0.687	0.843
	32. I listen for information from my body about my emotional state.	0.764	0.043	17.81	< .001	0.680	0.848
	33. When I am upset, I take time to explore how my body feels.	0.683	0.038	17.99	< .001	0.608	0.757
	34. I listen to my body to inform me about what to do.	0.756	0.039	19.20	< .001	0.678	0.833
	35. I am at home in my body.	0.738	0.038	19.37	< .001	0.663	0.812
	36. I feel my body is a safe place.	0.719	0.040	17.86	< .001	0.640	0.798
	37. I trust my body sensations.	0.665	0.043	15.45	< .001	0.581	0.749
Factor 2	18. When I am in conversation with someone, I can pay attention to my posture.	0.666	0.039	17.18	< .001	0.590	0.742
	19. I can return awareness to my body if I am distracted.	0.818	0.044	18.46	< .001	0.731	0.904
	20. I can refocus my attention from thinking to sensing my body.	0.817	0.041	19.79	< .001	0.736	0.898
	21. I can maintain awareness of my whole body even when a part of me is in pain or discomfort.	0.740	0.038	19.42	< .001	0.666	0.815
	22. I am able to consciously focus on my body as a whole.	0.733	0.039	18.80	< .001	0.657	0.809
	23. I notice how my body changes when I am angry.	0.687	0.039	17.43	< .001	0.610	0.764
	24. When something is wrong in my life I can feel it in my body.	0.485	0.038	12.70	< .001	0.410	0.559
Factor 3	1. When I am tense I notice where the tension is located in my body.	0.235	0.034	6.82	< .001	0.167	0.302
	2. I notice when I am uncomfortable in my body.	0.250	0.034	7.26	< .001	0.182	0.317
	3. I notice where in my body I am comfortable.	0.810	0.064	12.59	< .001	0.684	0.936

Factor	Indicator	Std. estimate	Std. Error	*z*-value	*p*	95% LLCI	95% ULCI
	4. I notice changes in my breathing, such as whether it slows down or speeds up.	0.695	0.056	12.40	< .001	0.585	0.805
Factor 4	12. I start to worry that something is wrong if I feel any discomfort.	-0.048	0.028	-1.69	.091	-0.103	0.008
	13. I can notice an unpleasant body sensation without worrying about it.	-0.588	0.039	-15.23	< .001	-0.663	-0.512
	14. I can stay calm and not worry when I have feelings of discomfort or pain.	-0.721	0.044	-16.39	< .001	-0.807	-0.635
	16. I can pay attention to my breath without being distracted by things happening around me.	-0.886	0.055	-16.04	< .001	-0.995	-0.778
Factor 5	6. I distract myself from sensations of discomfort.	0.597	0.064	9.40	< .001	0.473	0.722
	7. When I feel pain or discomfort, I try to power through it.	0.685	0.068	10.04	< .001	0.552	0.819
	8. I try to ignore pain.	0.385	0.053	7.27	< .001	0.281	0.489
	9. I push feelings of discomfort away by focusing on something.	0.860	0.081	10.57	< .001	0.701	1.020
	10. When I feel unpleasant body sensations, I occupy myself with something else so I don't have to feel them.	0.620	0.065	9.53	< .001	0.493	0.748

Table 7
Factor Loadings on Original Eight-Factor Structure After Removing the Four Items According to EFA

Factor	Indicator	Std. estimate	Std. Error	*z*-value	*p*	95% LLCI	95% ULCI
Noticing	1. When I am tense I notice where the tension is located in my body.	0.248	0.035	7.185	< .001	0.180	0.316
	2. I notice when I am uncomfortable in my body.	0.260	0.034	7.559	< .001	0.193	0.328
	3. I notice where in my body I am comfortable.	0.796	0.063	12.64	< .001	0.673	0.919
	4. I notice changes in my breathing, such as whether it slows down or speeds up.	0.699	0.056	12.46	< .001	0.589	0.809
Not-Distracting	5. (Deleted)						
	6. I distract myself from sensations of discomfort.	0.606	0.064	9.514	< .001	0.481	0.731
	7. When I feel pain or discomfort, I try to power through it.	0.690	0.068	10.12	< .001	0.557	0.824
	8. I try to ignore pain.	0.376	0.053	7.160	< .001	0.273	0.479
	9. I push feelings of discomfort away by focusing on something.	0.854	0.081	10.57	< .001	0.695	1.012
	10. When I feel unpleasant body sensations, I occupy myself with something else so I don't have to feel them.	0.614	0.065	9.504	< .001	0.488	0.741
Not-Worrying	11. (Deleted)						
	12. I start to worry that something is wrong if I feel any discomfort.	-0.022	0.033	-0.662	.508	-0.086	0.042
	13. I can notice an unpleasant body sensation without worrying about it.	-0.719	0.053	-13.69	< .001	-0.822	-0.616
	14. I can stay calm and not worry when I have feelings of discomfort or pain.	-0.888	0.064	-13.82	< .001	-1.014	-0.762
	15. (Deleted)						
Attention Regulation	16. I can pay attention to my breath without being distracted by things happening around me.	0.768	0.041	18.87	< .001	0.688	0.848
	17. (Deleted)						
	18. When I am in conversation with someone, I can pay attention to my posture.	0.665	0.039	17.13	< .001	0.589	0.741
	19. I can return awareness to my body if I am distracted.	0.823	0.045	18.44	< .001	0.735	0.910
	20. I can refocus my attention from thinking to sensing my body.	0.821	0.041	19.80	< .001	0.739	0.902
	21. I can maintain awareness of my whole body even when a part of me is in pain or discomfort.	0.739	0.038	19.40	< .001	0.665	0.814

Factor	Indicator	Std. estimate	Std. Error	*z*-value	*p*	95% LLCI	95% ULCI
	22. I am able to consciously focus on my body as a whole.	0.730	0.039	18.77	< .001	0.654	0.806
Emotional Awareness	23. I notice how my body changes when I am angry.	0.755	0.045	16.72	< .001	0.667	0.844
	24. When something is wrong in my life I can feel it in my body.	0.553	0.044	12.68	< .001	0.467	0.638
	25. I notice that my body feels different after a peaceful experience.	0.764	0.052	14.74	< .001	0.662	0.865
	26. I notice that my breathing becomes free and easy when I feel comfortable.	0.734	0.051	14.39	< .001	0.634	0.834
	27. I notice how my body changes when I feel happy / joyful.	0.802	0.052	15.54	< .001	0.701	0.903
Self-Regulation	28. When I feel overwhelmed I can find a calm place inside.	0.841	0.045	18.55	< .001	0.752	0.930
	29. When I bring awareness to my body I feel a sense of calm.	0.876	0.051	17.29	< .001	0.777	0.975
	30. I can use my breath to reduce tension.	0.752	0.043	17.34	< .001	0.667	0.837
	31. When I am caught up in thoughts, I can calm my mind by focusing on my body/breathing.	0.830	0.046	18.08	< .001	0.740	0.920
Body Listening	32. I listen for information from my body about my emotional state.	0.859	0.053	16.09	< .001	0.754	0.963
	33. When I am upset, I take time to explore how my body feels.	0.772	0.048	16.19	< .001	0.679	0.866
	34. I listen to my body to inform me about what to do.	0.855	0.051	16.91	< .001	0.756	0.954
Trusting	35. I am at home in my body.	0.898	0.052	17.10	< .001	0.795	1.000
	36. I feel my body is a safe place.	0.876	0.054	16.10	< .001	0.770	0.983
	37. I trust my body sensations.	0.806	0.056	14.32	< .001	0.696	0.916

Construct Validity: Correlations Between MAIA-2 Subscales and the Constructs

Correlations among MAIA-2 subscales and other measures are presented in Table 8. The Pearson coefficient is easy to be significant when N = 429. Hence, we list the results according to the absolute value, while $0.1 < r < 0.4$ as “weak”, $0.4 \le r \le 0.7$ as moderate, and $0.7 < r$ as strong correlation in the text while some coeffeicnts less than 0.1 are also significant (58).

The Noticing subscale showed moderate positive correlations with the Nonjudging subscale of the T-FFMQ, and weak positive correlations with the Describing, Nonreactivity, and total scores of the T-FFMQ; as well as General Positive Reactivity and all subscales of the PERS-S.

The Not-Distracting subscale demonstrated weak positive correlations with the Observing and Acting with Awareness of the T-FFMQ. In contrast, it showed weak negative correlations with Nonreactivity of the T-FFMQ, all subscales and total scores of the DASS-21, DERS-16, TAS, and General Negative Reactivity of the PERS-S.

The Not-Worrying subscale showed weak positive correlations with all but Nonjudging subscale with T-FFMQ subscales and total scores, as well as p General Positive Reactivity and its subscales of the PERS-S. In contrast, it showed moderate negative correlations with Stress of DASS-21, all subcales and total scores of DERS-16, and General Negative Reactivity of the PERS-S. Weak negative correlations presented with Depression, Anxiety, and total score of DASS-21, and TAS.

The Attention Regulation subscale showed moderate positive correlations with Describing, Nonjudging, Nonreactivity subscales and total score with T-FFMQ; weak positive correlations with Observing subscale of T-FFMQ, all subscale and total score of positive emotional reactivity of the PERS-S. In contrast, it showed weak negative correlations with subscales and total scores of DASS-21, DERS-16, TAS, and General Negative Reactivity of the PERS-S.

The Emotional Awareness subscale showed moderate positive correlations with Nonjudging subscale of T-FFMQ, General Positive Reactivity and positive Intensity. Weak positive correlations presented with Describing, Nonreactivity, and total score of T-FFMQ, as well as Ease of Activation and Duration of positive reactivity of PERS-S. In contrast, it showed weak negative correlations with Depression, Stress, and total score of DASS-21; Lack of Emotional Clarity, Impulse Control Difficulties, Limited Access to Effective Emotion Regulation Strategies subscales and total score of DERS-16; TAS; and General Negative Reactivity and its subscales of the PERS-S.

The Self-Regulation subscale showed moderate positive correlations with correlations with Describing and Nonreactivity subscale and total score of T-FFMQ, as well as General Positive Reactivity and its subscales of PERS-S. Weak positive correlations are presented with all other subscales of T-FFMQ. In contrast, it showed negative correlations with all subscales and total scores of DASS-21, DERS-16, TAS, General Negative Reactivity of PERS-S. Except for a moderate negative correlation with Limited Access to Effective Emotion Regulation Strategies of DERS-16, all other negative correlation strength were in the weak range.

The Body Listening subscale showed moderate positive correlations with Nonreactivity subscale and total score of T-FFMQ; it also showed weak positive correlations with Observing, Describing, and Nonjudging subscales of T-FFMQ, as well as General Positive Reactivity and its subscales of PERS-S. In contrast, weak negative correlations with Depression, Stress, and total score of DASS-21, as well as all subscales and total scores of DERS-16, TAS, and General Negative Reactivity of the PERS-S.

The Trusting subscale showed moderate positive correlations with correlations with Nonreactivity subscale and total score of T-FFMQ, as well as General Positive Reactivity and its subscales of PERS-S. In addition, weak positive correlations are presented in all other subscales of T-FFMQ. In contrast, it showed moderate negative correlations with Depression and total score of DASS-21, Limited Access to Effective Emotion Regulation Strategies subscale and total score of DERS-16. Weak negative correlations are presented with all other subscales of DASS-21 and DERS-16, as well as TAS and General Negative Reactivity and its subscales of PERS-S.

Table 8
Correlations Between MAIA-2 Subscales and the Constructs

1. N	N	N-D	N-W	A-R	E-A	S-R	B-L	T	MAIA-2
	—								
2. N-D	− .134**	—							
3. N-W	− .131**	.106*	—						
4. A-R	.391***	− .160***	.385***	—					
5. E-A	.599***	− .154**	.047	.632***	—				
6. S-R	.386***	− .111*	.427***	.731***	.623***	—			
7. B-L	.408***	− .144**	.246***	.671***	.629***	.741***	—		
8. T	.401***	− .058	.327***	.626***	.588***	.705***	.665***	—	
9. MAIA-2	.550***	.030	.449***	.829***	.767***	.882***	.833***	.836***	—
10. TFFMQ_O	− .033	.147**	.309***	.293***	.099*	.183***	.153**	.196***	.253***
11. TFFMQ_D	.206***	.039	.250***	.487***	.382***	.410***	.384***	.376***	.487***
12. TFFMQ_AA	− .049	.246***	.322***	.083	− .087	.119*	.021	.123**	.139**
13. TFFMQ_NJ	.411***	− .078	− .042	.420***	.428***	.301***	.350***	.310***	.405***
14. TFFMQ_NR	.231***	− .118*	.266***	.504***	.392***	.524***	.443***	.414***	.519***
15. TFFMQ	.248***	.096*	.382***	.598***	.397***	.507***	.446***	.474***	.602***
16. DASS_D	− .073	− .086	− .324***	− .273***	− .196***	− .331***	− .252***	− .485***	− .392***
17. DASS_A	.076	− .122**	− .288***	− .196***	− .050	− .175***	− .078	− .278***	− .213***
18. DASS_S	.031	− .145**	− .427***	− .303***	− .117*	− .353***	− .242***	− .379***	− .372***
19. DASS-21	.009	− .130**	− .387***	− .288***	− .138**	− .323***	− .217***	− .426***	− .366***
20. DERS_C	− .002	− .129**	− .295***	− .254***	− .133**	− .212***	− .141**	− .281***	− .274***
21. DERS_G	.041	− .120*	− .438***	− .320***	− .104*	− .349***	− .272***	− .359***	− .371***
22. DERS_I	− .017	− .126**	− .419***	− .330***	− .119*	− .357***	− .221***	− .322***	− .364***
23. DERS_S	− .009	− .113*	− .485***	− .335***	− .154**	− .402***	− .261***	− .433***	− .421***
24. DERS_NA	− .003	− .126**	− .412***	− .305***	− .094*	− .333***	− .186***	− .354***	− .346***
25. DERS-16	.001	− .134**	− .472***	− .349***	− .137**	− .385***	− .252***	− .403***	− .408***
26. TAS	− .057	− .160***	− .344***	− .326***	− .194***	− .305***	− .193***	− .324***	− .360***

1. N	N	N-D	N-W	A-R	E-A	S-R	B-L	T	MAIA-2
	—								
27. PERS_GPR	.303***	− .023	.303***	.380***	.412***	.483***	.358***	.511***	.526***
28. PERS_P_A	.265***	.009	.279***	.290***	.357***	.405***	.266***	.452***	.446***
29. PERS_P_I	.308***	− .063	.265***	.384***	.413***	.447***	.369***	.485***	.505***
30. PERS_P_D	.269***	− .011	.297***	.379***	.372***	.485***	.357***	.479***	.508***
31. PERS_GNR	.062	− .114*	− .520***	− .345***	− .161***	− .391***	− .295***	− .400***	− .417***
32. PERS_N_A	.072	− .104*	− .537***	− .349***	− .150**	− .389***	− .314***	− .395***	− .418***
33. PERS_N_I	.088	− .106*	− .477***	− .313***	− .136**	− .361***	− .276***	− .365***	− .376***
34. PERS_N_D	.011	− .111*	− .448***	− .309***	− .169***	− .350***	− .237***	− .366***	− .379***

* p < ,05; ** p < .01; *** p < .001.

N: Noticing; N-D: Not-Distracting; N-W: Not-Worrying; A-R: Attention Regulation; E-A: Emotional Awareness; S-R: Self-Regulation; B-L: Body Listening; T: Trusting; TFFMQ_O: T-FFMQ-Observing; TFFMQ_D: T-FFMQ_Describing; TFFMQ_AA: T-FFMQ-Acting with Awareness; TFFMQ_NJ: T-FFMQ_Nonjudging; TFFMQ_NR: T-FFMQ_Nonreactivity; DASS_D: DASS_Depression; DASS_A: DASS_Anxiety; DASS_S: DASS_Stress; DERS_C: DERS_Lack of Emotional Clarity; DERS_G: DERS_ Difficulties Engaging in Goal-Directed Behavior; DERS_I: DERS_ Impulse Control Difficulties; DERS_S: DERS_ Limited Access to Effective Emotion Regulation Strategies; DERS_NA: DERS_ Nonacceptance of Emotional Responses; PERS_GPR: PERS_General Positive Reactivity; PERS_P_A: PERS_ Ease of Activation of Positive Reactivity; PERS_P_I: PERS_ Intensity of Positive Reactivity; PERS_P_D: PERS_ Duration of Positive Reactivity; PERS_GNR: PERS_General Negative Reactivity; PERS_N_A: PERS_ Ease of Activation of Negative Reactivity; PERS_N_I: PERS_ Intensity of Negative Reactivity; PERS_N_D: PERS_ Duration of Negative Reactivity

Discussion

Overall, the MAIA-2 demonstrated good psychometric properties in the Taiwanese sample. Most indices of internal consistency, test–retest reliability, factorial validity, and construct validity fell within an acceptable to satisfactory range. However, the Noticing, Not-Distracting, and Not-Worrying subscales demonstrated comparatively weaker performance, such that most of the indices fell within questionable to acceptable range. Although the EFA identified a five-factor structure that differed from the original model, CFA results indicated that modified eight-factor structure (comprised with 33 items) showed better fit than the other two models ($\triangle$CFI = .048 & .042, compared with the original eight-factor model and five-factor model, respectively). Furthermore, findings regarding factor structure and construct validity appeared to suggest a tendency toward overgeneralization across different psychological processes. This phenomenon may be related to characteristics of the Taiwanese sample and warrants further investigation.

The internal consistency and test–retest reliability of the MAIA-2 total score were satisfactory, although greater variability was observed across subscales. Regarding internal consistency, the Noticing and Not-Worrying subscales fell within the questionable range, whereas the remaining subscales demonstrated acceptable or higher reliability according to recommended criteria (52). Regarding test–retest reliability, the stability of the Noticing subscale appeared relatively limited,

while the remaining subscales demonstrated moderate or higher stability (59). These findings are consistent with previous studies conducted across different cultural contexts, which have similarly reported weaker psychometric performance for the Noticing (22, 26, 28, 30) and Not-Worrying (6, 24, 29, 30) subscales. When look into EFA and CFA results, there is also problems in items of Not-Worrying subscale. The item 11 was double loaded in EFA, factor loading of item 12 was not significant in original CFA, and item 15 was not sufficiently loaded in EFA. Worry about bodily sensations is closed related to illness attitude among both clinical and nonclinical populations (60, 61). Similarly, higher sensitivity to bodily sensations is also widely found among individuals with panic, higher health anxiety or hypochondria (61–64). Hence, the Noticing and Not-Worrying may be more "contaminated" with health-related psychological processes than other subscales. Another possibility is such scales including items refer to "positive" and "negative" valences at the same time (e.g., "I notice when I am uncomfortable in my body" and "I notice where in my body I am comfortable"; "I start to worry that something is wrong if I feel any discomfort" and "I can notice an unpleasant body sensation without worrying about it"). In this sample, clear opposite correlation patterns emerged between positive and negative constructs. Specifically, constructs characterized by positive psychological functioning, including mindfulness (T-FFMQ) and positive emotional reactivity (PERS-S-GPR and positive subscales), demonstrated similar correlation patterns, whereas constructs involving negative affective functioning, including depression, anxiety, and stress symptoms (DASS-21), emotion regulation difficulties (DERS-16), alexithymia (TAS), and negative emotional reactivity (PERS-S-GNR and negative subscales), showed an opposite pattern. Hence, the reliability of scales comprised with items referred to both emotional valences may be reduced due to such response patterns.

The five-factor structure extracted in the present study showed partial correspondence with the original eight-factor structure, and a more "over-generalization" pattern was inferred by EFA result. Factor 1 consisted of several items from Emotional Awareness, together with all items from Self-Regulation, Body Listening, and Trusting, comprising 13 items in total. Factor 2 included several items from Attention Regulation and Emotional Awareness, comprising seven items. Factor 3 corresponded entirely to the original Noticing subscale, consisting of four items. Factor 4 consisted of three items from Not-Worrying and one additional item originally belonging to Attention Regulation (Item 16), comprising four items. Factor 5 corresponded to Not-Distracting, except for Item 5, which demonstrated insufficient factor loading, resulting in five items. Notably, Factor 1 included subscales involving the use of bodily sensations in subsequent regulatory processes, as well as positive aspects of emotional awareness. These items were highly associated with positive emotional valence. In contrast, the use of negative bodily sensations for emotional awareness appeared to be incorporated into Factor 2, which was primarily composed of items from Attention Regulation and reflected awareness of neutral or negative experiences. This pattern is similar to the correlation pattern regarding positive and negative valence mentioned above. Taken together, these findings suggest that the emotional valence of questionnaire items may exert a meaningful influence on responses. One possible explanation is that participants' responses may have been influenced by item valence, resulting in response bias and insufficient representation of the underlying psychological processes intended to be measured (65). However, an alternative interpretation warrants further consideration. Emotional education has historically received relatively limited attention in Taiwanese society and has only gained increasing recognition during the past decade (66). Subsequently, the "undifferentiated" nature of emotional disturbances is clinically considered among Taiwanese population (67). Therefore, difficulties in differentiating emotional processes may reflect characteristics of limited emotional awareness within this sample rather than merely representing response bias.

Another finding potentially related to emotional awareness processes concerns several problematic items identified in the factor analyses. Except for problematic item 17, all other problematic items discussed above (items 5, 11, 12 and 15) were all based on experiences of bodily discomfort or pain. In Taiwanese populations, physical discomfort and pain may be less likely to be understood through an emotional framework or as "neutral" experiences that can be regulated and utilized, and are more commonly interpreted as harmful physiological problems requiring medical treatment. For example, concepts such as the historically used term "neurasthenia" and the more recently prevalent concept of "autonomic dysregulation" are often understood as being associated with emotional stress responses but remain frequently discussed within contexts relevant to physiological illness (68). Therefore, when questionnaire items describe bodily discomfort, participants' responses may be influenced by illness-related or medical explanatory frameworks. Consequently, validity concerns regarding these items may

reflect differences in the underlying interoceptive processing characteristics of this sample compared with the samples from which the original measure was developed.

Regarding the overall factor structure, the present findings provided greater support for the original eight-factor model after removing problematic items. Although the CFI and TLI values of all three CFA models (the original eight-factor model, the EFA-derived five-factor model, and the modified eight-factor model after removing the same items) did not reach the conventional acceptable criterion proposed by Hu and Bentler (56), all models demonstrated good RMSEA values (< .06), and only the modified eight-factor model achieved an acceptable SRMR value (< .08). Marsh, Hau (57) further suggested that model evaluation should not be reduced to whether models achieve universal cutoff criteria, but should instead consider theoretical considerations and relative model fit. According to the △CFI, the modified eight-factor structure was with best fit identified in the present study. This finding is partially consistent with the results of Scheffers, Coenen (22), who also identified a factor structure different from the original model (a six-factor solution), while CFA results nevertheless indicated better performance of the original eight-factor structure. These findings appear to suggest that the eight-factor structure of the MAIA-2 demonstrates cross-cultural application, while appropriate modifications may further improve its applicability for specific populations.

Construct validity analysis indicated generally good performance of MAIA-2, however, further investigation of mind-body process of Taiwanese is needed. The Not-Worrying, Self-Regulation and Trusting subscales showed satisfied construct validity that all hypotheses were supported. Some subscales showed no significant correlations with hypothesized constructs, including the Noticing with the Observing (mindfulness), the Attention Regulation with the Acting with Awareness, the Emotional Awareness with the Observing (mindfulness) and Nonacceptance of Emotional Responses (emotion dysregulation), and the Body Listening with the Acting with Awareness. Those were inconsistent with Mehling, Price (5)'s original hypotheses and findings, and might be resulted from the participant differences that Mehling, Price (5) study specifically recruited individuals have regular mind-body practices, such as mindfulness meditation, yoga, Tai-Chi, etc.; in contrast, this study did not specify relevant experiences. Hence, the participants may exhibit weaker association between mind and body due to less relevant experiences (31). However, a surprising finding was that the Not-Distracting exhibited weakly negative correlation with the Nonreactivity dimension of mindfulness. It is noteworthy that weakly but significant negative correlation between those subscale was also found Teng, Wang (31). Teng, Wang (31) suggested the difference may due to participants difference mentioned above. However, such difference could result in "no positive correlation", and it is not sufficient to explain the existence of negative association. Cultural differences on experiential avoidance may play a role here. While individuals are "default" to avoid negative experiences, distracting from unpleasant bodily sensations is habitual and with minimal cognitive effort (69). In contrast, being not distracting is actually an effortful reaction, hence may lead to negative correlation between Not-Distracting and Nonreactivity. A recent meta-analysis showed East Asians reported higher experiential avoidance than Westerners (70). Both this study (Taiwan) and Teng, Wang (31) (China) conducted in East Asia, hence may exhibited higher experiential avoidance than USA participants of Mehling's (5). Another finding contradict to hypotheses is on negative emotional reaction. Almost all MAIA-2 subscales show negative correlations with negative emotional reaction subscales, while the Noticing and Body-Listening to hypothesized to be positively correlated to ease of activation of negative emotion. The phenomena may be resulted in the valence effect overriding psychological process per se discussed above. It is also consistent to the suggestion that, with higher experiential avoidance, noticing unpleasant bodily sensations directly lead to avoidance of negative feelings. Hence, such inconsistent findings indicate more sophisticated consideration on Taiwanese is needed.

There are several limitations of this study and future directions. Online survey with community adults restrained the ecological validity. Future psychometric studies should be conducted among clinical populations with emotional or physical problems, as well as younger and older participants. Level of mind-body experiences was not measured in this study, which decrease the extent of comparison with original version. Including participants of various levels of mind-body experiences would help to compare psychometric properties with original version. Finally, constructs which might affect reliability and validity performances, such as the valence effect, vagueness of emotional process, and experiential avoidances, could be included to disentangle the interoceptive sensibility and emotion processes among Taiwanese in future.

Conclusions

The MAIA-2 demonstrated good internal consistency, one-month test-retest reliability, factorial validity, and construct validity. Although EFA extracted a five-factor solution, CFA indicated that the modified eight-factor structure (with item 5, 15, 11 and 17 removed) provided better fit than both five-factor and original eight-factor model. These findings suggest that the original multidimensional conceptualization of interoceptive sensibility is generally applicable to the Taiwanese population, although minor modifications may improve its psychometric performance.

Among the eight subscales, the Noticing, Not-Distracting, and Not-Worrying subscales demonstrated comparatively weaker psychometric performance. These findings are consistent with previous validation studies, suggesting that these subscales may require further refinement or cultural adaptation.

In addition, the EFA and construct validity findings suggest a possible tendency toward overgeneralization among the Taiwanese sample. Whether this pattern reflects a cultural characteristic, a language-related effect, or a unique aspect of interoceptive processing in Taiwanese populations remains unclear and warrants further investigation. Future studies are encouraged to examine the cross-cultural measurement invariance of the MAIA-2 and to further explore the mechanisms underlying these findings

Declarations

Ethics approval and consent to participate:

All experiments were performed in accordance with the Declaration of Helsinki.The study protocol was approved by the Research Ethics Committee of the National Chengchi University (Approval No. NCCU-REC-202311-E110). Written informed consent were collected online before the questionnaire collection.

Consent for publication:

Not applicable.

Competing interests:

The authors declare that they have no competing interests.

Funding:

The study was funded by National Science and Technology Council of Taiwan, Grant No. NSTC 113-2410-H-431-002.

Author Contribution

Y.-H. H. was responsible for conception, acquisition, analysis, and interpretation of data and manuscript formation.

Acknowledgement

The author thank Professor Chien-Ming Yang, Professor Chih-Hsun Wu and Professor Fan-Chi Hsiao for helping with the funding acquisition, as well as all the assistants who helped the administrative procedure and case management throughout the project.

Data Availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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