

# Unveiling the mirage of mindfulness profiles through mindfulness-based stress reduction

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## ABSTRACT

**Objectives:** The Five Facet Mindfulness Questionnaire (FFMQ) stands out as a standard of mindfulness assessment in scientific literature, although scientific understanding of its properties is still in development. Among them, the FFMQ seems to present latent profiles with specific patterns in its facets. However, no study has explored the behavior of mindfulness profiles across mindfulness-based interventions. This study explores how Mindfulness-Based Stress Reduction (MBSR) impacts mindfulness profiles.

**Methods:** An overall sample of 624 participants were measured pre and post-MBSR in mindfulness, decentering, self-compassion, psychopathological symptoms, well-being, and positive and negative emotional states.

**Results:** MBSR altered the structure of latent profiles, shifting from 3 profiles to 2 profiles: A High Mindfulness minority profile and a General Mindfulness majority profile. These profiles could be interpreted as a single dispositional mindfulness continuum. The Judgmentally Observing and Non-Judgmentally Aware profiles were more present in the High Mindfulness profile post-MBSR. All profiles tended to display increased decentering, self-compassion, well-being, and positive states, while decreased negative states and psychological symptoms. Thus, MBSR seemed to “arrange” latent profiles in a continuum of overall mindfulness.

**Conclusions:** MBSR seems to dissipate heterogeneities in the FFMQ, allocating its measurements to a more homogeneous continuum of mindfulness. Implications and recommendations for future studies are discussed.

## 1. Introduction

Mindfulness is defined as present-centered voluntary awareness with a non-judgmental and detached attitude (Kabat-Zinn, 1990). Research on mindfulness has experienced exponential growth in academic literature (American Mindfulness Research Association (AMRA), 2021). Scientific interest has centered mainly on the impacts of Mindfulness-Based Interventions (MBIs). Specifically, in the MBIs effects on mental health (e.g., depression relapse, anxiety, psychopathology, psychological well-being) and physical health (e.g., chronic pain, immune response). In brief, an MBI typically consists of a standardized protocol of weekly training sessions with a certified instructor in mindfulness-based meditation techniques (e.g., awareness of breath).

Meta-analytic evidence and reviews suggest that MBIs seem to hold reliable and valid effects (Creswell, 2017; Creswell, Lindsay, Villalba, & y Chin, 2019; Slemple, Jach, Chia, Loton, & y Kern, 2019; van Agteren et al., 2021; Wielgosz, Goldberg, Kral, Dunne, & Davidson, 2019) and are worthy of investment and scalable implementations (e.g., Mindfulness All-Party Parliamentary Group, 2015; Bristow, 2019; Leggett, 2021).

Nevertheless, a scientific understanding of mindfulness is still in development. Part of the scientific knowledge of mindfulness has come from developing self-report instruments (Baer, 2019). The Five Facet Mindfulness Questionnaire (FFMQ) is one of the most well-known and used (Baer et al., 2006, 2008), with a wide use and impact in academic and applied contexts. The FFMQ measures mindfulness as an overall

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psychological construct with five main facets, named: “Observe” as the tendency to observe stimuli (e.g., sensations of the wind in the body), “Describe” as the tendency to describe those stimuli verbally; “Acting with Awareness” as the tendency to attend to one’s activities in the present moment (in contrast with behaving mechanically or driven by “automatic pilot”); “Non-Judging of Inner Experience” as the tendency to not judge a particular inner experience as good or bad; “Non-Reacting to Inner Experience” as the tendency to not immediately react to a particular inner experience and “take a step back” to gain perspective.

Scientific literature holds an ambiguous landscape regarding the psychometric properties of the FFMQ. While meta-analytic evidence suggests generally robust validity regarding associations with other variables (Carpenter, Conroy, Gomez, Curren, & Hofmann, 2019; Mattes, 2019), validity regarding latent structures and contents holds some challenging evidence. Regarding content validity, some studies challenge the FFMQ as potentially inconsistent in detecting changes in dispositional mindfulness after an MBI (Goldberg et al., 2015). Regarding construct validity, most validation studies showed methodological concerns, while the standard latent structure of the FFMQ showed replicability issues (Lecuona, García-Garzón, García-Rubio, & Rodríguez-Carvajal, 2020). Moreover, recent contributions propose alternative structures, like six facets (splitting Acting with Awareness in two) without an overall mindfulness factor (Karl et al., 2020; Lecuona, García-Rubio, de Rivas, Moreno-Jiménez, & Rodríguez-carvajal, 2021). A recent study expanded these inquiries longitudinally across an Acceptance and Commitment Therapy (ACT) intervention (Levin-Aspenson, Marks, Dalrymple, & Zimmerman, 2023). Studying the short form of the FFMQ in a large clinical sample (n = 2928) and testing facets without the overall mindfulness factor, they reported issues with fitting this structure, requiring model modifications. This emphasizes the challenges of construct validity of the FFMQ.

We argue that if an instrument as widely used as the FFMQ to measure mindfulness shows concerns, the mindfulness construct or its mechanisms may be affected. This landscape of simultaneous scientific uncertainty and high popularity can lead to misinterpretations in diverse audiences (e.g., excessively negative views of the whole mindfulness field or applied users using the FFMQ ignoring scientific concerns). Thus, it seems beneficial to study further the complexities of FFMQ’s psychometric properties. More concretely, we propose person-oriented assessments of dispositional mindfulness to unveil potential mirages in FFMQ scores, like mindfulness profiles (see Lecuona et al., 2020, for a review). These profiles can be defined as groups of individuals showing specific patterns of mindfulness facets via Latent Profile Analysis (LPA). Like Latent Class Analysis, LPA allows estimating a latent discrete variable, given a group of continuous items (in this case, mindfulness facets). In the case of the FFMQ, literature generally proposes four profiles (Table 1): Low-Mindfulness, High-Mindfulness, “Non-judgmentally Aware”, and “Judgmental Observing.” While Low and High Mindfulness are intuitive (low or high values in all facets), the remaining two require a detailed description: Non-Judgmentally Aware generally features high values in non-judging and Acting with Awareness, while also relatively low values in Observe and Describe. This is, individuals that tend to be present-centered and to not label experiences as good or bad, but also tend to be less attentive to external stimuli and have less skills to put experiences into words (e.g., kind of “aloof”). In contrast, Judgmental Observing features high values in Observe and Describe, while also low values in Non-Judging and Acting with Awareness. This is, individuals that are highly alert to external stimuli and skilled in describing them verbally. However, maybe because of a lack of training in decentering from those verbal descriptions, they are also prone to discriminate them as good or bad (i.e., to judge them and react fused with them) and to be less present-centered.

High- and Low-Mindfulness profiles can be interpreted as manifestations of a continuum of overall mindfulness, making them compatible with previous findings (e.g., profiles such as General Mindfulness, Medium-to-High or Medium-to-Low Mindfulness; Lecuona,

**Table 1**  
Studies using latent profile analysis for the FFMQ.

Reference	Population	Long or short form	# profiles	Name of profiles
Pearson et al. (2015)	College students (N = 941)	Long	4	Low mindfulness, high mindfulness, non-judgmentally aware, judgmentally observing
Bravo et al. (2016)	College students (N = 688)	Long	4	
Kimmes et al. (2017)	Couples (young adults) (N = 542)	Long	4	
Bravo et al. (2018)	Military personnel (N = 407), college students (N = 310)	Long	4	
Lam et al. (2018)	Cancer patients (N = 418)	Short	4	
Zhang et al. (2019)	Early Adolescents (N = 670)	Long	4	
Gu et al. (2020)	Recurrent depression (N = 683)	Long	4	
Ford et al. (2020)	Adults (N = 715)	Long	4 <sup>a</sup>	
Stanmyre et al., (2022)	Gamblers (N = 843)	Short	4	
Sahdra et al. (2017)	Adults (N = 7884)	Short	4	Average mindfulness, moderately non-judgmental, non-judgmentally aware, judgmentally observing
Calvete et al. (2019)	Adolescents (N = 571)	Short	3	Moderate mindfulness, non-judgmentally aware, judgmentally observing
Zhu et al. (2020)	Adults (N = 1727)	Long	3	Low to average mindfulness, average mindfulness, high non-judgmentally aware
Bronchain et al. (2021)	Young adults using cannabis (N = 1572)	Short	3	High mindfulness, non-judgmentally aware, judgmentally observing
Marques et al. (2020)	Sleep disturbance (N = 74)	Long	2 <sup>a</sup>	Low mindfulness, high mindfulness
Gómez-Odrizola & Calvete (2021)	Adolescents with sleep disturbance (N = 304)	Short	2	Moderate mindfulness, non-judgmentally aware

Note:

<sup>a</sup> Implemented Cluster Analysis.

García-Rubio, De Rivas, Moreno-Jiménez, & Rodríguez-Carvajal, 2022; Sahdra et al., 2017; Zhu, Wang, & Schroevers, 2020). However, the Judgmentally Observing and Non-judgmentally Aware display heterogeneous patterns of mindfulness facets, which seem to replicate across samples (Table 1).

Regarding associations with other variables, High- and Low-Mindfulness profiles show the same predictive patterns as studies with

dispositional mindfulness scores as a continuum (for reviews and meta-analysis, see Carpenter et al., 2019; Tomlinson et al., 2018; Wielgosz et al., 2019). This is, higher psychological well-being, happiness, self-compassion, optimism, and satisfaction, while lower psychopathology (especially anxiety and depression), neuroticism, and negative affect for the High-Mindfulness profile, while *vice versa* for the Low-Mindfulness profile (e.g., Marques, Gomes, & Pereira, 2020; see Lecuona et al., 2022, for a review). Nevertheless, the remaining two heterogeneous profiles (Non-judgmentally Aware and Judgmentally Observing) show mixed evidence. In most studies, the Non-judgmentally Aware profile seems to be more functional than the Judgmentally Observing one, with lower levels of psychopathology and neuroticism (Bravo et al., 2016, 2018; Kimmes, Durtschi, & Fincham, 2017; Lam, Lim, Kua, Griva, & Mahendran, 2018; Pearson, Lawless, Brown, & Bravo, 2015; Sahdra et al., 2017). However, some other studies report both profiles with intermediate levels of psychopathology, well-being, self-compassion, optimism, and satisfaction (e.g., Calvete, Fernández-González, Echezarraga, & Orue, 2019; Ford, Wilson, Altman, Strough, & Shook, 2020; Sahdra et al., 2017). Moreover, other studies report the Judgmentally Observing profile with lower negative affect and higher life effectiveness, happiness, self-compassion, and positive affective states than the Non-Judgmentally Aware (Ford et al., 2020; Lecuona et al., 2022; Sahdra et al., 2017). Despite this mixed landscape, almost all studies find common ground regarding these two profiles: They tend to display specular or inverse behaviors between them. This is, the Judgmentally Observing profile shows high Observe and Describe and low Acting with Awareness and Non-Judging, while the Non-Judgmentally Aware profile shows low Observe and Describe while higher Acting with Awareness and Non-Judging. These two profiles seem relatively prevalent (for a review, see Lecuona et al., 2022; Sahdra et al., 2017), thus highlighting the heterogeneities of mindfulness scores in the general population. These heterogeneous profiles could be proposed as an explanatory cause for the construct validity issues of the FFMQ.

Therefore, evidence suggests some degree of internal and external validity of mindfulness profiles. However, we propose a series of improvements to the field. Among them, as Pearson et al. (2015) pointed out, the LPA maps a single timestamp of mindfulness profiles. Nevertheless, Latent Transition Analysis (LTA) extends LPA to a longitudinal framework. This allows the study of how MBIs may impact the diverse mindfulness profiles. Recent evidence found longitudinal metric invariance (i.e., equal factor loadings allow the comparison of scores) in all scales across ACT for all facets (Levin-Aspenson et al., 2023). However, scalar invariance (i.e., equal item means) only was assumable after including modification indices, but strict invariance (i.e., equal item residuals) was not assumable even after including modification indices (Levin-Aspenson et al., 2023; for a review on measurement invariance, see Leitgöb et al., 2023, Table 1). Given that ACT shares some components with MBIs as third-wave therapies (e.g., mindfulness), this can be regarded as first evidence of the usability of the FFMQ facets to explore the longitudinal impacts of MBIs.

Given evidence of MBIs increasing mindfulness levels (Creswell, 2017), a preliminary hypothesis would be that different profiles will enhance their mindfulness levels. We can apply this framework to relevant variables associated with mindfulness and trained by MBIs, such as decentering (Bernstein, Hadash, & Fresco, 2019) and self-compassion (Rodríguez-Carvajal, García-Rubio, Paniagua, García-Diex, & De Rivas, 2016; Williams & Kabat-Zinn, 2013). Possibly, people on different mindfulness profiles would improve in these skills after a third-wave intervention, such as ACT or an MBI. Similarly, mental health on different mindfulness profiles can improve after an MBI, expecting higher well-being or positive affect and lower stress, depression, anxiety, and negative affect in all latent mindfulness profiles.

This study aims to explore how mindfulness profiles might change over an MBI (in this case, Mindfulness-Based Stress Reduction or MBSR, as one of the most validated by evidence; Creswell, 2017) and its

relations to positive (self-compassion, decentering, positive states, and well-being) and negative (stress, anxiety, depression, and negative states) mental health constructs. More concretely, our hypotheses are: (1) the 3-profile structure (i.e., General Mindfulness, Non-judgmentally Aware, and Judgmentally Observing) will remain stable across the MBSR; (2) like findings in a previous study (Lecuona et al., 2022), the Judgmentally Observing profile will have higher levels of well-being (i.e., self-compassion, positive affective states, well-being), and lower levels of mental ill-being (i.e., negative affect, psychopathology) than the General Mindfulness profile post-MBSR; and (3) the Non-Judgmentally Aware profile will have lower levels of well-being, and higher levels of mental ill-being than the General Mindfulness profile post-MBSR. These two hypotheses contradict previous literature but are proposed due to using the same participants from a previous study (Lecuona et al., 2022).

## 2. Method

### 2.1. Participants

As described in a previous study (Lecuona et al., 2022), we obtained an overall sample of 826 participants by merging two samples of MBSR attendees of the same mindfulness center. Samples were apt for merging due to highly similar characteristics (same mindfulness center, instructors, intervention, procedure and mindfulness, and self-compassion self-reports), only differing in external variables' self-reports. Of the overall sample, 624 participants completed pre- and post-MBSR measurements. The first sample (with 344 participants after removing dropouts) was measured in mindfulness, self-compassion, decentering, positive and negative states, and perceived stress. The second sample (280 participants with no dropouts) was measured in mindfulness, self-compassion, depression, anxiety, stress, and well-being. Participants displayed a majority identified as women (72.64%), middle-aged ( $M = 43.26$ ,  $SD = 10.41$ ), with college studies or above (65.85%), coupled or married (46.85%), and had practiced meditation before at least once (60.29%). No significant differences were found in demographics between samples ( $p > 0.05$ ) except age (with a small difference of 2 years older in sample 2) and marital status (with sample 2 displaying more proportions of divorced and fewer single participants). No significant differences were found in self-reports between samples pre and post-MBSR ( $p > 0.05$ ) except for Describe (sample 1 scoring 0.2 points higher in pre-MBSR), Acting with Awareness (the same but with sample 2), and some facets of self-compassion like overidentification (sample 1 scoring 0.2 points higher in pre-MBSR) and isolation (sample 2 scoring 0.5 points higher in post-MBSR). Note that relevant differences appeared in non-judging (sample 1 scoring 0.8 points higher in pre-MBSR) and non-reacting (sample 2 scoring 0.4 points higher both pre and post-MBSR). Therefore, type of sample was taken into account in available analyses.

### 2.2. Measures

#### 2.2.1. Five facets of mindfulness questionnaire – short form (FFMQ-SF)

This instrument aims to measure mindfulness with 21 self-reported items and a Likert response format from 1 (*totally disagree*) to 5 (*totally agree*) (Bohlmeyer, Klooster, Fledderus, Veehof, & Baer, 2011; Tran, Glück, & Nader, 2013; validated to Spanish population by Asensio-Martínez et al., 2019). As discussed, it has two proposed latent structures of five or six facets (Karl et al., 2020; Lecuona et al., 2020) and a hierarchical overall factor. However, the six-facet model was discarded due to not counting with at least three items per latent variable. Internal consistencies of all instruments are displayed in Table S2. Facets include Observe (“I pay attention to sensations, such as the wind in my hair or sun in my face”), for Describe (“I can usually describe how I feel at the moment with considerable detail”), for Acting with Awareness (“I find it difficult to stay focused on what’s happening in the present”, reversed),

Non-Judging (“When I have distressing thoughts or images, I judge myself as good or bad, depending what the thought/image is about”, reversed), and Non-Reacting (“When I have distressing thoughts or images, I “step back” and am aware of the thought or image without getting taken over by it”).

### 2.2.2. Self-compassion scale – short form (SCS-SF)

This instrument aims to measure self-compassion with 12 self-reported items and a Likert response format from 1 (*almost never*) to 5 (*almost always*) (Raes et al., 2011; validated to Spanish population by Garcia-Campayo et al., 2014). Its latent structure includes an overall Self-Compassion facet and six first-level factors, namely Self-Kindness (e.g., “I try to be loving towards myself when I’m feeling emotional pain”), Self-Judgment (e.g., “I’m disapproving and judgmental about my own flaws and inadequacies”), Common Humanity (e.g., “When things are going badly for me, I see the difficulties as part of life that everyone goes through”), Isolation (e.g., “When I think about my inadequacies, it tends to make me feel more separate and cut off from the rest of the world”), Mindfulness (e.g., “When something upsets me I try to keep my emotions in balance”), and Overidentification (e.g., “When I’m feeling down I tend to obsess and fixate on everything that’s wrong”). Internal consistencies were unavailable for the first-level facets due to not counting with at least three items per factor, but for the general factor are displayed in Table S2.

### 2.2.3. Experiences questionnaire (EQ)

This instrument aims to measure decentering with 11 self-reported items and a Likert response format from 1 (*never*) to 5 (*all the time*) (Fresco et al., 2007; validated to Spanish population by Soler et al., 2014). Its latent structure includes an overall detachment factor (“I notice that I don’t take difficulties so personally”).

### 2.2.4. Self-other five immeasurables (SOFI)

This instrument aims to measure Buddhist immeasurable states (loving-kindness, compassion, empathetic joy, and equanimity) with 16 self-reported items and a Likert response format from 1 (*very slightly or not at all*) to 5 (*extremely*) (Kraus & Sears, 2009). Its latent structure includes four factors, namely self-positive states (e.g., “I feel friendly towards myself”), self-negative states (e.g., “I feel hateful towards myself”), other-positive states (e.g. “I feel friendly towards others”) and other-negative states (e.g. “I feel hateful towards others”).

### 2.2.5. Perceived stress scale (PSS)

This instrument aims to measure perceived stress with 10 self-reported items and a Likert response format from 0 (*never*) to 4 (*very often*) (Cohen, Kamarck, & Mermelstein, 1983; validated to Spanish population by Remor, 2006; Trujillo & González-Cabrera, 2007). Its latent structure includes an overall perceived stress factor (“In the last month, how often have you been upset because of something that happened unexpectedly?”).

### 2.2.6. Depression, anxiety and stress scale 21 (DASS-21)

This instrument aims to measure stress, depression, and anxiety symptoms with 21 self-reported items and a Likert response format from 1 (*never*) to 5 (*always*) (Lovibond & Lovibond, 1995; validated to Spanish by Daza, Novy, Stanley, & Averill, 2002). Its latent structure includes three factors of Depression (“I felt down-hearted and blue”), Anxiety (“I felt scared without any good reason”), and Stress (“I felt that I was using a lot of nervous energy”).

### 2.2.7. Pemberton happiness index (PHI) – section A

This instrument aims to measure general eudaimonic well-being with 11 self-reported items and a Likert response format from 0 (*totally disagree*) to 10 (*totally agree*) (Hervás & Vázquez, 2013). Its latent structure includes an overall well-being factor (“I think my life is useful and worthwhile”).

## 2.3. Procedure

The university ethics committee approved the research study before participant recruitment. Informed consent was given by all participants following the Declaration of Helsinki protocols. When registering for the MBSR program on the official mindfulness center website, we invited participants to join the study. Those who agreed to participate completed an online questionnaire on sociodemographic data and inclusion criteria (not undergoing psychiatric or intense medical treatment, not currently training on another MBI or related, being over 18 years old, and voluntarily enrolling in the MBSR). In addition, all participants signed an informed consent form. Participants completed an online assessment before and after the MBSR with the self-reports described in the materials section. Assessments lasted about 25–30 min via Qualtrics. The first sample was recruited in this context, while the second sample was recruited in the same official mindfulness center but with different self-reports. The pre-assessment was carried out one week before the beginning of the MBSR, and the post-assessment was filled in during the last week of the program. At the end of the post-assessment, each participant received a report that showed their changes during the MBSR program in the questionnaire’s measures.

The official curriculum of the MBSR program was followed. This is, 32-h training during eight weeks, including a 3-h initial orientation session, seven weekly 2.5-h presentational sessions, an 8-h intensive day of practice, 45 min of daily home formal and informal practices, and a final 3.5-h session (Kabat-Zinn, 1990). Regarding the facilitators, the instructors that conducted the MBSR programs were highly experienced in facilitating the MBSR program (i.e., more than six years of teaching experience and a minimum of 30 MBSR programs conducted). All of them were certified by the University of Massachusetts Center for Mindfulness (<https://www.umassmed.edu/cfm/>).

## 2.4. Data analyses

First, to assess if MBSR provided significant effects in our sample, we implemented repeated-measures ANCOVA with previous meditation practice, age, and gender as covariables and examined correlations in both times. In addition, we implemented Confirmatory Factor Analyses (CFAs) to FFMQ’s post-MBSR scores using the five-correlated factor model (convergent with prior literature, Levin-Aspenson, 2023). See Supplementary Materials for details on these analyses.

To explore latent profiles in the FFMQ and its transitions across MBSR, we followed the framework by Ryoo, Wang, Swearer, Hull, and Shi (2018; Fig. 1) indicating testing invariance of profile across time. We applied Latent Profile Analysis (LPA, Williams & Kibowski, 2016) to mindfulness facets, following Ferguson, Moore, E. W, and Hull (2020). Our data did not converge for standard estimation methods (i.e., MPlus), so we interpreted that measurement invariance testing was unable with our data and proceeded to implement a repeated measures LPA (Ryoo et al., 2018). This is, estimate separated LPAs for pre and post-MBSR and obtain its classification estimates for subsequent analysis (e.g., associations of latent profiles across time and with other variables).

To obtain the best fitting number of profiles, we estimated LPAs as reported in a previous study (Lecuona et al., 2022) to mindfulness facets post-MBSR. Selected fit indices were the entropy index and the bootstrapped Likelihood Ratio Test (BLRT) as a priority due to marginally high power (from 20 to 70%), and the Akaike Information Criterion (AIC), the Bayesian Information Criterion (BIC), the Sample Adjusted BIC (SABIC) and the Corrected Akaike Information Criterion (CAIC) as complements due to lower power. As commented in a previous study (Lecuona et al., 2022), we considered our sample size as generally valid since  $n > 500$ , but we prioritized BLRT and entropy fit indices. AIC, BIC, SABIC, and CABIC will not be interpreted unless they show consensus or clear deviations from their tendency towards models with more profiles. All fit indices were obtained for LPA models iteratively increasing the number of profiles and selecting the LPA solution with the best-fit

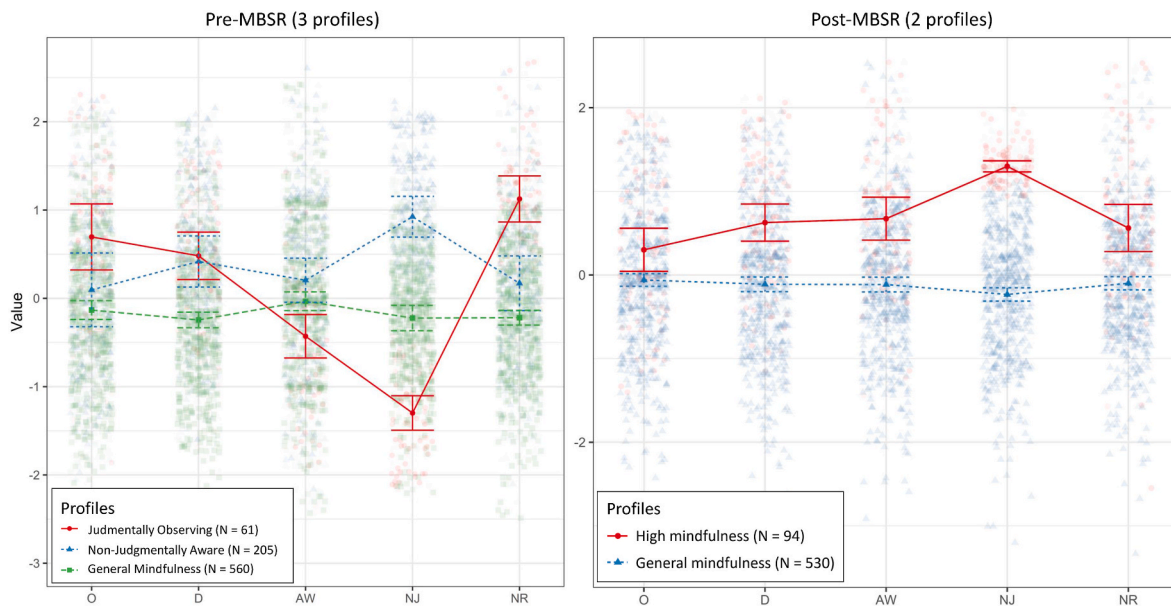


Fig. 1. Depiction of the three-profile model pre-MBSR (from Lecuona et al., 2022) and the two-profile model post-MBSR defined by pattern of standardized means, confidence intervals and raw data on five facets of mindfulness.

indices.

Once the LPA models were selected, facet means were estimated with 95% confidence intervals in each profile. Scatterplots of facets for each profile were also examined (available in Supplementary Materials). Finally, relations between profiles and external variables were assessed with one-way ANCOVAs post-MBSR and compared with those reported in a previous study (Lecuona et al., 2022). Sample was also included as a covariable. A power analysis revealed, for our sample sizes and with 95% confidence and 95% power, minimum effect sizes of  $\eta_p^2 = [0.023; 0.068]$  (see Supplementary Materials). Means with confidence intervals and significant differences via *post hoc* comparisons were reported (applying Šidák correction). Both means and *post hoc* comparisons were bootstrapped with 1,000 draws. If dependent variables displayed pronounced skewness, we implemented Kruskal-Wallis tests with DSCF *post hoc* comparisons. Scatterplots of indicators and external variables were examined for each profile. Finally, we interpreted the profiles using all previously obtained information.

To explore the changes in the mindfulness profile over time, we applied two analyses. First, we applied contingency tables with profiles pre and post-MBSR. We implemented log linear regression (due to not meeting the assumptions for common techniques), with profiles post-MBSR as a dichotomous variable, profiles pre-MBSR as a polytomous variable, and sample as a covariable. We also computed and plotted the contingency table, with Pearson residuals for each cell ( $|values| > 2$  or 4 indicating significant transitions).

Second, we applied three-way ANCOVAs with time (pre vs. post), profiles pre-MBSR, and profiles post-MBSR as independent variables, meditation practice and sample as a covariable, and each external variable as the dependent variables. With these analyses, we could examine the relation between profiles and external variables pre and post-MBSR. A power analysis revealed, for our sample sizes and with 95% confidence and 95% power, minimum effect sizes of  $\eta_p^2 = [0.009; 0.020]$  for interactions between pre and post-MBSR with latent profiles and of  $\eta_p^2 = [0.034; 0.074]$  for interactions between latent profiles (see Supplementary Materials). Main effects and interactions were estimated and interpreted if significant ( $p < 0.05$ ). Marginal means with 95% confidence intervals were estimated, bootstrapped with 1,000 draws, and interpreted.

Descriptive statistics, correlations, ANCOVAs, and contingency

tables were computed with JASP (JASP Team, 2020), except for the Kruskal-Wallis test with *post hoc* comparisons, computed with Jamovi (Jamovi Project, 2020). CFAs, reliability indices, and LPAs were computed with the *lavaan* (Rosseel, 2012), *MBESS* (Kelley, 2007), and *tidyLPA* packages (Rosenberg et al., 2018, 2019) of the R environment (R Development Core Team, 2020), respectively. Power Analyses were computed using G\*Power (Faul, Erdfelder, Buchner, & Lang, 2009). All data, scripts, and supplementary materials are available at the Open Science Framework ([https://osf.io/f627a/?view\\_only=01bcc2b3fda544df942be97b49e9d821](https://osf.io/f627a/?view_only=01bcc2b3fda544df942be97b49e9d821)).

### 3. Results

All self-report variables showed significant improvements post-MBSR with adequate power, while all seemed to correlate with each other as expected (see Supplementary Materials). Thus, the MBSR seemed to significantly and positively impact the overall sample (i.e., increasing mindfulness and positive mental health and reducing negative mental health).

The selected LPAs for each type of model post-MBSR are displayed in Table 2. In contrast with unclear fit pre-MBSR (Lecuona et al., 2022), the LPAs provided clearer support for a solution post-MBSR. These results also imply that the measurement invariance would not fit if a Latent Transition Analysis were implemented since the number of latent profiles seems to change across the MBSR.

The selected two models (three latent profiles pre-MBSR and two latent profiles post-MBSR) are displayed in Fig. 1. Pre-MBSR, the 3-profile solution showed a homogeneous General Mindfulness profile (with similar levels across all facets) and two heterogeneous groups (“Judgmentally Observing” and “Non-Judgmentally Aware”). Post-MBSR, the two groups also displayed linear levels across the five facets: One group with high levels in all facets, especially Non-Judging (named “High-Mindfulness”), and the other profile showing a similar pattern that the General Mindfulness profile pre-MBSR, thus naming it also “General Mindfulness.” Note that this profile does not fully correspond to the General Mindfulness pre-MBSR (see Fig. 5).

Table 3 displays the means and *post hoc* significant comparisons of each latent profile pre and post-MBSR in mindfulness facets, well-being, and ill-being variables, and demographic variables (pre-MBSR data was retrieved from another study (Lecuona et al., 2022)). As reported there,

**Table 2**  
Fit indices for LPAs post-MBSR from 1 to 7 profiles in three different types of models.

Model	Profiles	LogLik	AIC	BIC	CAIC	SABIC	Entropy	BLRT
1	1	-4098,17	8216,33	8260,69	8270,69	8228,95	1	-
	2	-3698,09	7428,17	7499,15	7515,15	7448,35	0,77	800,16*
	3	-3563,80	7171,61	7269,20	7291,20	7199,36	0,78	268,57*
	4	-3495,91	7047,81	7172,02	7200,02	7083,13	<b>0,82</b>	135,80*
	5	-3463,45	6994,90	7145,72	7179,72	7037,78	0,77	64,92*
	6	-3438,60	6957,20	<b>7134,65</b>	<b>7174,65</b>	7007,65	0,76	49,69*
	7	-3428,07	6948,14	7152,20	7198,20	7006,16	0,71	21,06*
2	1	-4098,17	8216,33	8260,69	8270,69	8228,95	1	-
	2	-3691,45	7424,90	7518,06	7539,06	7451,39	0,79	813,43*
	3	-3539,52	7143,05	7285,00	7317,00	7183,41	0,77	303,85*
	4	-3468,17	7022,34	<b>7213,09</b>	<b>7256,09</b>	7076,57	0,78	142,71*
	5	-3454,73	7017,46	7257,01	7311,01	7085,57	<b>0,80</b>	26,87
	6	-3425,53	6981,06	7269,41	7334,41	7063,05	<b>0,83</b>	58,40*
	7	-3403,43	6958,86	7296,00	7372,00	7054,71	<b>0,82</b>	44,21*
3	1	-3411,73	6863,45	<b>6952,17</b>	<b>6972,17</b>	<b>6888,68</b>	1	-
	2	-3403,77	6859,55	6974,89	7000,89	6892,34	0,57	15,90
	3	-3393,49	6850,98	6992,94	7024,94	6891,34	0,69	20,57*
	4	-3397,93	6871,86	7040,43	7078,43	6919,79	0,47	-8,8
	5	-3379,41	6846,81	7042,00	7086,00	6902,31	0,65	37,05*
	6	-3373,62	6847,24	7069,05	7119,05	6910,31	0,68	11,57
	7	-3356,87	6825,74	7074,17	7130,17	6896,38	0,80	33,50*
6	1	-3411,73	6863,45	6952,17	6972,17	6888,68	1	-
	2	-3299,91	6681,81	<b>6863,69</b>	<b>6904,69</b>	<b>6733,52</b>	<b>0,94</b>	223,64*
	3	-3361,32	6846,64	7121,68	7183,68	6924,84	0,54	-122,82
	4	-3242,40	6650,80	7019,00	7102,00	6755,49	<b>0,92</b>	237,84*
	5	-3319,47	6846,93	7308,29	7412,29	6978,11	<b>0,80</b>	-154,13
	6	-3223,84	6697,68	7252,20	7377,20	6855,34	<b>0,85</b>	191,25*
	7	-3214,61	6721,22	7368,90	7514,90	6905,37	<b>0,86</b>	18,46
Best models from each type								
1	4	-3495,91	7047,81	7172,02	7200,02	7083,13	<b>0,82</b>	135,80*
2	6	-3425,53	6981,06	7269,41	7334,41	7063,05	<b>0,83</b>	58,40*
3	1	-3411,73	6863,45	<b>6952,17</b>	<b>6972,17</b>	<b>6888,68</b>	1	-
6	2	-3299,91	6681,81	<b>6863,69</b>	<b>6904,69</b>	<b>6733,52</b>	<b>0,94</b>	223,64*
Decision (model; profiles)		Not interpreted	Not interpreted	6; 2	6; 2	6; 2	6; 2	6; 2

Note. In the “Models” column: 1 = equal variances, covariances fixed to zero; 2 = varying variances, covariances fixed to zero; 3 = equal variances and equal covariances; 6 = varying variances and varying covariances; Entropy and BLRT labels are bolded to indicate their preference in interpretation. \* $p < 0.05$ ; Bolded numbers indicate the best fit in that fit index for that model (from 1 to 7 profiles) in that set of models (type 1, 2, 3 or 6). This is, entropy  $> 0.80$ , BLRT with  $p > 0.05$  in the next model, or the smallest number in LogLik, AIC, BIC, CAIC, and SABIC, apart from tendency to better fit for models with more profiles.

the General Mindfulness profile displayed expected levels in all variables. The Judgmentally Observing profile displayed functional patterns (high self-compassion and well-being, low psychopathology). The Non-judgmentally Aware profile displayed more dysfunctional ones (i. e., medium-to-low self-compassion and well-being, high psychopathology), but also the high decentering and positive states, suggesting a heterogeneous behavior. These nuances and heterogeneities were absent post-MBSR, with expectable associations with all profiles. The General Mindfulness profile showed higher levels of self-compassion, decentering, positive states and well-being that in pre-MBSR, while also lower levels of psychopathology (but not of perceived stress and negative states). The High-Mindfulness profile showed significantly higher scores in decentering, self-compassion, positive states, and well-being than the General Mindfulness profile (post-MBSR). Moreover, it showed significantly lower perceived stress, depression, anxiety, stress, and negative states. There were no significant differences in age, gender, level of studies, or minimum meditation experience. In addition, correlations between mindfulness facets and other self-report variables were heterogeneous across profiles pre-MBSR, while post-MBSR were more consistent across profiles (see Supplementary Materials).

### 3.1. Profile changes across MBSR

Loglineal regression found a significant association between latent profiles pre and post-MBSR (Deviance = 64.18 (1),  $p < 0.001$ ). More concretely, the interaction effect was significant between General Mindfulness pre and post-MBSR ( $\lambda = 2.17$ ,  $p < 0.001$ , 95%CI = [1.39–2.95]). This means that a significant association is found between both General Mindfulness profiles; this is, participants “staying” in this

profile across MBSR are more frequently than other trajectories. Sample was significantly associated with Non-Judgmentally Aware ( $\lambda = -5.62$ ,  $p < 0.001$ , 95%CI = [-7.76 to -3.47]) and General Mindfulness pre-MBSR ( $\lambda = -2.95$ ,  $p < 0.001$ , 95%CI = [-4.39 to -1.54]). This means that sample 1 counted with fewer members of those profiles than sample 2. However, the three-way interaction was not significant ( $p > 0.05$ ), which means that there were no clear associations of transitions between profiles and type of sample. Examining the specific shifts in the contingency table (Fig. 2), we confirm that General Mindfulness “stayers” are the most prevalent cell, with 64% of the overall sample. In contrast, 7% of participants “upgraded” to a High Mindfulness profile, while also 36% of previously Judgmentally Observing and 31% of Non-Judgmentally Aware were also “upgraders.” Nevertheless, the High Mindfulness profile was scarce and mostly composed significantly by people of heterogeneous profiles (Judgmentally Observing and Non-Judgmentally Aware). Comparing samples (Supplementary materials, Figure S2), we found minor differences except for the Judgmental Observing profile, where sample 2 had a significantly higher number of “upgraders” while sample 1 had only 2 participants from said profile (in contrast, sample 2 had fewer participants of the Non-judgmentally Aware profile). All other transitions followed the overall pattern.

The three-way repeated-measures ANCOVAs showed several significant effects with adequately powered effect sizes (Table S6). Means with 95%CIs are displayed in Fig. 3, Fig. 4, and Fig. 5. Since the figures can be complex, we will follow this procedure: Participants from the [profile pre-MBSR] pre-MBSR that shifted to [profile post-MBSR] post-MBSR showed an [increase/decrease] in [dependent variable] across the MBSR. For example, Participants from the Judgmentally Observing profile pre-MBSR that shifted to High-Mindfulness post-MBSR showed a

**Table 3**

Mean comparisons between latent profiles pre and post-MBSR on mindfulness facets, psychological constructs, emotional outcomes, and psychological well-being.

	Pre-MBSR			Post-MBSR	
	General Mindfulness	Judgmentally Observing	Non-Judgmentally Aware	High Mindfulness	General Mindfulness
	M (SE)	M (SE)	M (SE)	M (SE)	M (SE)
FFMQ-SF - Observe	3.50 <sup>2</sup> (0.06)	4.03 <sup>1</sup> (0.08)	3.65 <sup>2</sup> (0.07)	3.79 <sup>1</sup> (0.05)	3.67 <sup>2</sup> (0.05)
FFMQ-SF - Describe	3.27 <sup>2</sup> (0.05)	3.67 <sup>1</sup> (0.05)	3.80 <sup>1</sup> (0.05)	3.66 <sup>1</sup> (0.04)	3.49 <sup>2</sup> (0.04)
FFMQ-SF - Acting with Awareness	3.13 <sup>2</sup> (0.05)	3.00 <sup>2</sup> (0.06)	3.41 <sup>1</sup> (0.05)	3.28 <sup>1</sup> (0.04)	3.07 <sup>2</sup> (0.04)
FFMQ-SF - Non-Judging	3.37 <sup>2</sup> (0.05)	2.87 <sup>3</sup> (0.06)	4.22 <sup>1</sup> (0.05)	3.73 <sup>1</sup> (0.04)	3.25 <sup>2</sup> (0.04)
FFMQ-SF - Non-Reacting	2.79 <sup>3</sup> (0.04)	3.41 <sup>1</sup> (0.05)	3.01 <sup>2</sup> (0.04)	3.13 <sup>1</sup> (0.03)	3.02 <sup>2</sup> (0.03)
SCS-SF - Self-Compassion	2.77 <sup>3</sup> (0.03)	3.74 <sup>1</sup> (0.10)	3.37 <sup>2</sup> (0.07)	4.10 <sup>1</sup> (0.06)	3.58 <sup>2</sup> (0.03)
Self-Kindness	2.70 <sup>3</sup> (0.04)	3.71 <sup>1</sup> (0.12)	3.24 <sup>2</sup> (0.07)	4.01 <sup>1</sup> (0.09)	3.52 <sup>2</sup> (0.04)
Self-Judgment	2.71 <sup>2</sup> (0.05)	3.60 <sup>1</sup> (0.13)	3.34 <sup>1</sup> (0.08)	4.31 <sup>1</sup> (0.07)	3.53 <sup>2</sup> (0.04)
Common Humanity	2.86 <sup>3</sup> (0.04)	3.78 <sup>1</sup> (0.12)	3.29 <sup>2</sup> (0.07)	3.67 <sup>1</sup> (0.11)	3.42 <sup>2</sup> (0.04)
Isolation	2.81 <sup>2</sup> (0.05)	3.76 <sup>1</sup> (0.13)	3.53 <sup>1</sup> (0.08)	4.26 <sup>1</sup> (0.08)	3.74 <sup>2</sup> (0.04)
Mindfulness	3.02 <sup>3</sup> (0.04)	3.97 <sup>1</sup> (0.09)	3.54 <sup>2</sup> (0.08)	4.06 <sup>1</sup> (0.07)	3.72 <sup>2</sup> (0.03)
Over-Identification	2.54 <sup>2</sup> (0.04)	3.62 <sup>1</sup> (0.14)	3.30 <sup>1</sup> (0.08)	4.33 <sup>1</sup> (0.07)	3.55 <sup>2</sup> (0.04)
Decentering	2.86 <sup>2</sup> (0.03)	3.57 <sup>1,2</sup> (0.24)	3.43 <sup>1</sup> (0.04)	4.08 <sup>1</sup> (0.06)	3.67 <sup>2</sup> (0.03)
SOFI - Positive	3.19 <sup>2</sup> (0.03)	3.07 <sup>2</sup> (0.26)	3.76 <sup>1</sup> (0.04)	4.37 <sup>1</sup> (0.07)	3.78 <sup>1</sup> (0.04)
Self	2.94 <sup>2</sup> (0.04)	2.89 <sup>3</sup> (0.17)	3.67 <sup>1</sup> (0.06)	4.34 <sup>1</sup> (0.07)	3.70 <sup>1</sup> (0.05)
Others	3.43 <sup>1</sup> (0.03)	3.25 <sup>2</sup> (0.13)	3.84 <sup>1</sup> (0.04)	4.41 <sup>1</sup> (0.07)	3.86 <sup>1</sup> (0.04)
Psychological Well-Being <sup>†</sup>	6.91 <sup>2</sup> (0.11)	8.36 <sup>1</sup> (0.17)	5.82 <sup>3</sup> (0.36)	8.86 <sup>1</sup> (0.16)	7.91 <sup>2</sup> (0.08)
Perceived Stress	3.06 <sup>1</sup> (0.04)	3.21 <sup>1,2</sup> (0.53)	2.45 <sup>2</sup> (0.05)	1.84 <sup>2</sup> (0.06)	2.38 <sup>1</sup> (0.04)
SOFI - Negative	1.76 <sup>2</sup> (0.04)	1.88 <sup>1,2</sup> (0.33)	1.40 <sup>2</sup> (0.03)	1.15 <sup>2</sup> (0.03)	1.42 <sup>1</sup> (0.03)
Self	1.81 <sup>1</sup> (0.04)	2.01 <sup>1,2</sup> (0.44)	1.34 <sup>2</sup> (0.04)	1.09 <sup>2</sup> (0.03)	1.40 <sup>1</sup> (0.03)
Others	1.72 <sup>1</sup> (0.04)	1.75 <sup>1,2</sup> (0.28)	1.46 <sup>2</sup> (0.04)	1.21 <sup>2</sup> (0.04)	1.44 <sup>1</sup> (0.03)
DASS-21 - Depression <sup>†</sup>	0.43 <sup>2</sup> (0.05)	0.14 <sup>3</sup> (0.05)	1.14 <sup>1</sup> (0.19)	0 <sup>2</sup> (0.01)	0.29 <sup>1</sup> (0.03)
DASS-21 - Anx <sup>†</sup>	0.43 <sup>2</sup> (0.04)	0.14 <sup>2</sup> (0.04)	0.57 <sup>1</sup> (0.11)	0.14 <sup>2</sup> (0.04)	0.29 <sup>1</sup> (0.01)
DASS-21 - Stress <sup>†</sup>	1.14 <sup>2</sup> (0.04)	0.71 <sup>3</sup> (0.05)	1.57 <sup>1</sup> (0.11)	0.43 <sup>2</sup> (0.11)	0.79 <sup>1</sup> (0.03)
%Exp. With meditation	56.61 <sup>2</sup>	73.77 <sup>1</sup>	66.34 <sup>2</sup>	66.00 <sup>1</sup>	59.06 <sup>1</sup>
%Female	72.5 <sup>1</sup>	80.33 <sup>1</sup>	70.73 <sup>1</sup>	71.28 <sup>1</sup>	72.64 <sup>1</sup>
Age	43.14 <sup>1</sup> (0.46)	43.54 <sup>1</sup> (1.29)	43.49 <sup>1</sup> (0.76)	43.93 <sup>1</sup> (1.02)	43.89 <sup>1</sup> (0.47)
Studies	5 <sup>1</sup> (0.06)	5 <sup>1</sup> (0.09)	5 <sup>1</sup> (0.131)	5 <sup>1</sup> (0.15)	5 <sup>1</sup> (0.06)

Note. Pre-MBSR retrieved from A previous study (Lecuona et al., 2022). Superscripts indicate *post hoc* differences between profiles (different superscripts = significant differences, same superscript = non-significant differences), and ordered in magnitude (<sup>1</sup> = the profile with highest value, and the others ranked in order). <sup>†</sup> = non-parametric ANOVAs and DSCF *post hoc* tests were implemented due to high skewness (standard errors were obtained using medians instead of means).

significant increase in the non-judging facet across the MBSR.

Fig. 3 shows mindfulness facets across MBSR in each profile. Overall, participants tended to increase their mindfulness scores post-MBSR. This was particularly intense in the Judgmentally Observing profile, with an increase of approximately 3 SDs in Non-Judging and 1 SD in Acting with Awareness, regardless of which profile they were post-MBSR. The Non-Judgmentally Aware profile also showed relevant improvements (although less intense), the most pronounced in the Non-Reacting and Observe facets. The General Mindfulness profile also showed improvements in all cases but in Acting with Awareness for participants with similar levels that remained in the General Mindfulness profile post-MBSR. The only decrease was for participants in the Non-Judgmentally Aware profile that shifted to the General Mindfulness post-MBSR, with a small decrease in Non-Judging.

Fig. 4 displays self-compassion, decentering, positive states, and well-being results. General increases within all profiles were found. However, the high Mindfulness profile showed higher increases and a cumulative pattern. This was not the case for participants who ended in the General Mindfulness: Participants who remained in this profile showed lower scores than the Judgmentally Observing profile in self-compassion, decentering, and well-being. Some profiles were not available to test or displayed very broad confidence intervals due to counting with a very small size or not at all in certain profiles. This was also the case in psychopathology, negative states and perceived states. Finally, well-being scores present a relevant skewness, which reflects a potential ceiling effect.

Finally, Fig. 5 displays results for depression, anxiety, stress, negative states, and perceived stress. All variables showed significant decreases in all variables. Decreases were more intense in participants who ended in the General Mindfulness post-MBSR. This could be due to skewness in participants who ended in the High Mindfulness profile (i.e., floor effects). The Judgmentally Observing profile showed low levels in

depression, anxiety, and stress, with even some non-significant changes. The Non-Judgmentally Aware profile showed more intense decreases in these variables, but only for participants that ended in the General Mindfulness profile. Finally, participants that remained in this profile showed intense decreases in almost all variables.

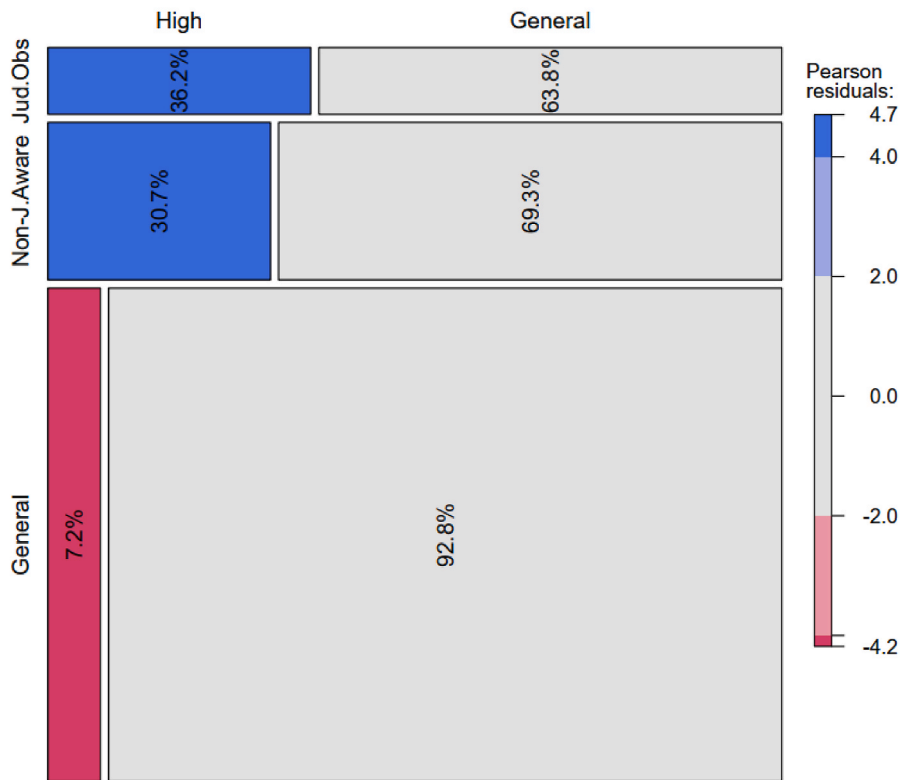
#### 4. Discussion

This study explored how mindfulness profiles (measured with the FFMQ) changed across the MBSR. To do so, we expanded our previous evidence (Lecuona et al., 2022) to a longitudinal framework applying MBSR to the sample. Our results show that, contrary to our first hypothesis, mindfulness profiles change structurally across MBSR. The number and patterns of mindfulness profiles are different pre and post-MBSR, changing from a heterogeneous landscape to a more homogeneous one. More concretely, from three profiles pre-MBSR (i.e., General Mindfulness, Judgmentally Observing and Non-Judgmentally Aware) to only two profiles after MBSR training: A General Mindfulness profile with a broad range of values and a High-Mindfulness profile (especially in the Non-Judging facet). This could be explained as MBSR focusing on defusion or decentering attitudes. This structural change not only is compatible with prior literature reporting good fit post-MBSR (e.g., Baer et al., 2008), but also proposes an explanation to latent models not fitting well pre-MBSR. Therefore, meditation training could make structural impacts in their participants, which seems positive regarding the efficacy of interventions but challenging regarding measurement.

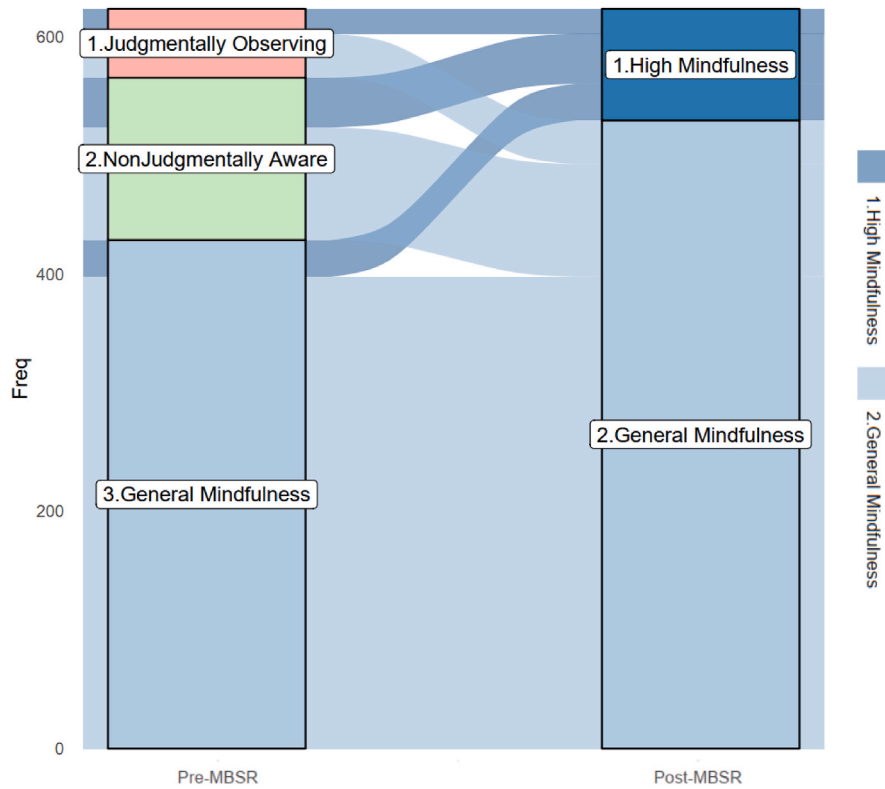
Regarding structural impacts, we propose that these results suggest that participating in an MBSR could provoke two overlapping processes. The first process would be a genuine and effective modification of the psychological structure of participants. This is, ordering the psyche according to MBSR contents and making profound changes in their relations to phenomena (i.e., more awareness and defusion). This is

# Mindfulness profiles across MBSR

## A. Mosaic plot



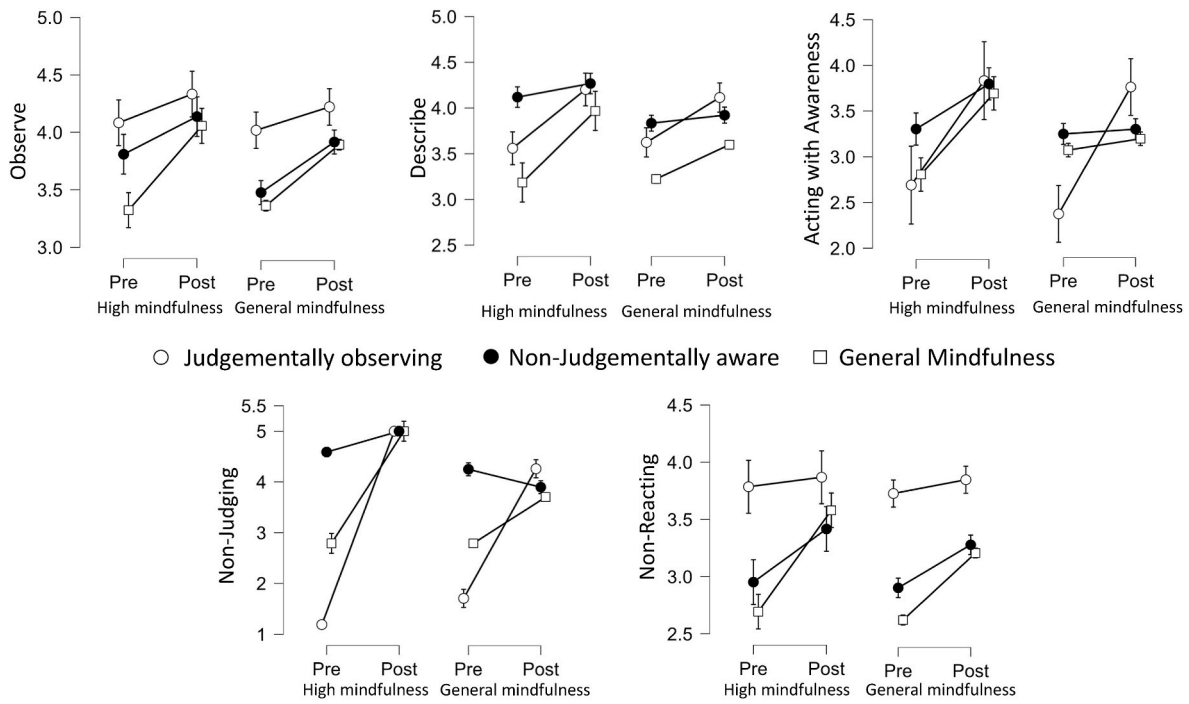
## B. Alluvial plot



(caption on next page)

**Fig. 2.** Means and confidence intervals of mindfulness facets for each profile pre and post MBSR.

**Note** Since interpretations can be complex, we propose the following procedure: Participants from the [General Mindfulness/Judgmentally Observing/Non-Judgmentally Aware] pre-MBSR ([respective color line]) and shifted to [High Mindfulness/General Mindfulness] post-MBSR showed an [increase/decrease] in [dependent variable] across the MBSR. Two examples are provided. Example 1: Participants from the Judgmentally Observing profile pre-MBSR (white dots) and shifted to the High-Mindfulness profile post-MBSR showed a significant increase in the non-judging facet across the MBSR. Example 2: Participants from the General Mindfulness pre-MBSR (white squares) and shifted to the High-Mindfulness profile post-MBSR showed a decrease in the observe, describe, and acting with awareness facets across the MBSR.



**Fig. 3.** Means and confidence intervals of self-compassion, decentering, positive states and happiness for each profile pre and post MBSR.

**Note** Since interpretations can be complex, we propose the following procedure: Participants from the [General Mindfulness/Judgmentally Observing/Non-Judgmentally Aware] pre-MBSR ([respective color line]) and shifted to [High Mindfulness/General Mindfulness] post-MBSR showed an [increase/decrease] in [dependent variable] across the MBSR. Two examples are provided. Example 1: Participants from the Judgmentally Observing profile pre-MBSR (white dots) and shifted to the High-Mindfulness profile post-MBSR showed a significant increase in the non-judging facet across the MBSR. Example 2: Participants from the General Mindfulness pre-MBSR (white squares) and shifted to the High-Mindfulness profile post-MBSR showed a decrease in the observe, describe, and acting with awareness facets across the MBSR.

compatible with prior literature (Baer et al., 2008; Roca, Diez, Castellanos, & Vazquez, 2019). The second process would be for MBSR to train participants to answer self-reports in line with the current scientific understanding of mindfulness. This is because MBSR could involuntarily instruct participants to respond to the FFMQ according to its psychometric model. Therefore, the FFMQ would be exposed to validity issues regarding response processes. This seems also compatible with prior literature (Choi, Farb, Pogrebtsova, Gruman, & Grossman, 2021; Goldberg et al., 2015; Levin-Aspenson et al., 2023). More concretely, from a naïve or popular understanding of mindfulness as mainly attention to the present, to a scientific one which includes defusion/decentering attitudes, such as non-judging (Choi et al., 2021).

#### 4.1. Profile changes across MBSR – mindfulness facets

Regarding our second and third hypotheses, we could not test them due to structural changes in mindfulness profiles. Therefore, we will prioritize the exploration of profile transitions or shifts. Results show that mindfulness profiles seemed to transition mainly to the General Mindfulness profile and a minority to the High-Mindfulness profile. However, the heterogeneous profiles shifted significantly more than expected to the High-Mindfulness profile post-MBSR. Participants who “upgraded” to a high dispositional mindfulness post-MBSR are more likely to be from the Judgmental Observing or Non-Judgmentally Aware profiles. A potential interpretation is that these “upgraders” already had

some mindfulness skills that MBSR triggered, or that MBSR was especially impactful for them.

The Judgmentally Observing profile stands out as the most benefitted from the MBSR, with changes of even three standard deviations regardless of the profile they ended post-MBSR. This is an extremely infrequent increase to find. Since this is the first study to explore changes in mindfulness profiles across MBSR, we cannot rely on the literature. We propose three hypotheses: First, these increases may be genuine and the Judgmentally Observing profile can obtain extreme profits in mindfulness training by MBSR. Second, participants of this profile could be already capable of not judging their inner experiences (i. e., not self-punishing, or defuse diagnosis) but were wrongly self-reporting as highly judgmental. And third, social desirability could be especially present in these participants. We prioritize interpreting these findings with caution and recommend future studies to test the replicability of these results and if so, test these hypotheses.

The Non-Judgmentally Aware profile showed less intense benefits and some small differences between the ones shifting to the High Mindfulness or the General Mindfulness profiles. We interpret this as a derived feature of the profile in this sample, with less intense patterns pre-MBSR. This could be due to specific response processes of this profile, like being highly non-judgmental makes experiences less filtered and thus with less self-perception of choosing extreme Likert values. However, the MBSR impacted this group in particular ways. Participants from this profile who “upgraded” to the High-Mindfulness group

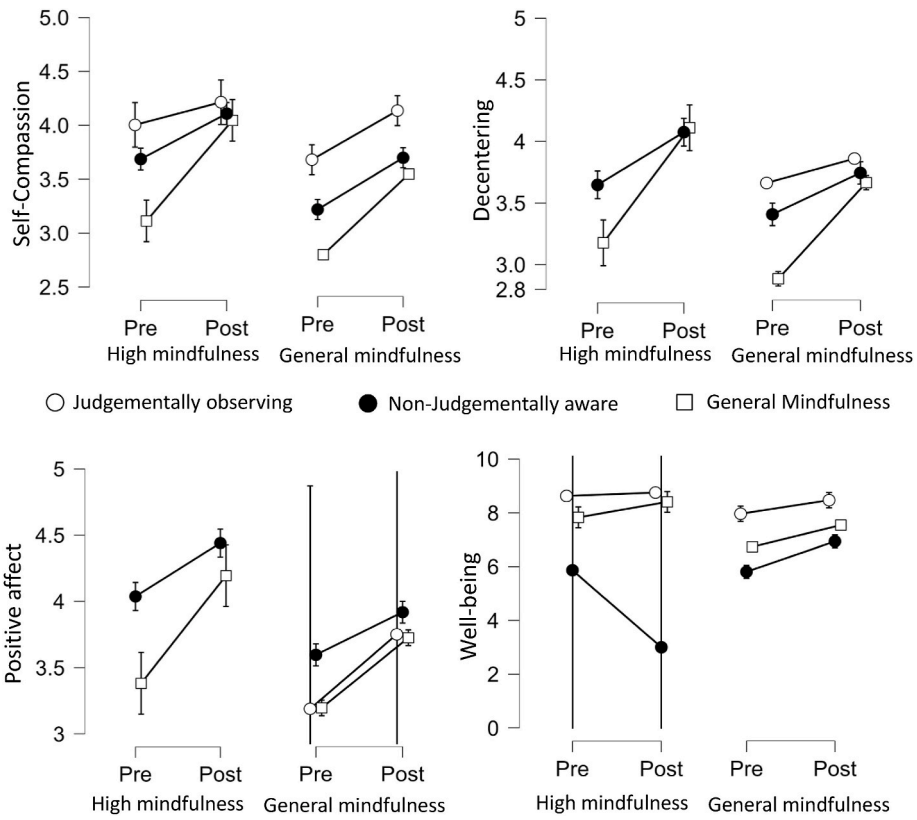


Fig. 4. Means and confidence intervals of depression, anxiety, stress, perceived stress, and negative states for each profile pre and post MBSR.

**Note** Since interpretations can be complex, we propose the following procedure: Participants from the [General Mindfulness/Judgmentally Observing/Non-Judgmentally Aware] pre-MBSR ([respective color line]) and shifted to [High Mindfulness/General Mindfulness] post-MBSR showed an [increase/decrease] in [dependent variable] across the MBSR. Two examples are provided. Example 1: Participants from the Judgmentally Observing profile pre-MBSR (white dots) and shifted to the High-Mindfulness profile post-MBSR showed a significant increase in the non-judging facet across the MBSR. Example 2: Participants from the General Mindfulness pre-MBSR (white squares) and shifted to the High-Mindfulness profile post-MBSR showed a decrease in the observe, describe, and acting with awareness facets across the MBSR.

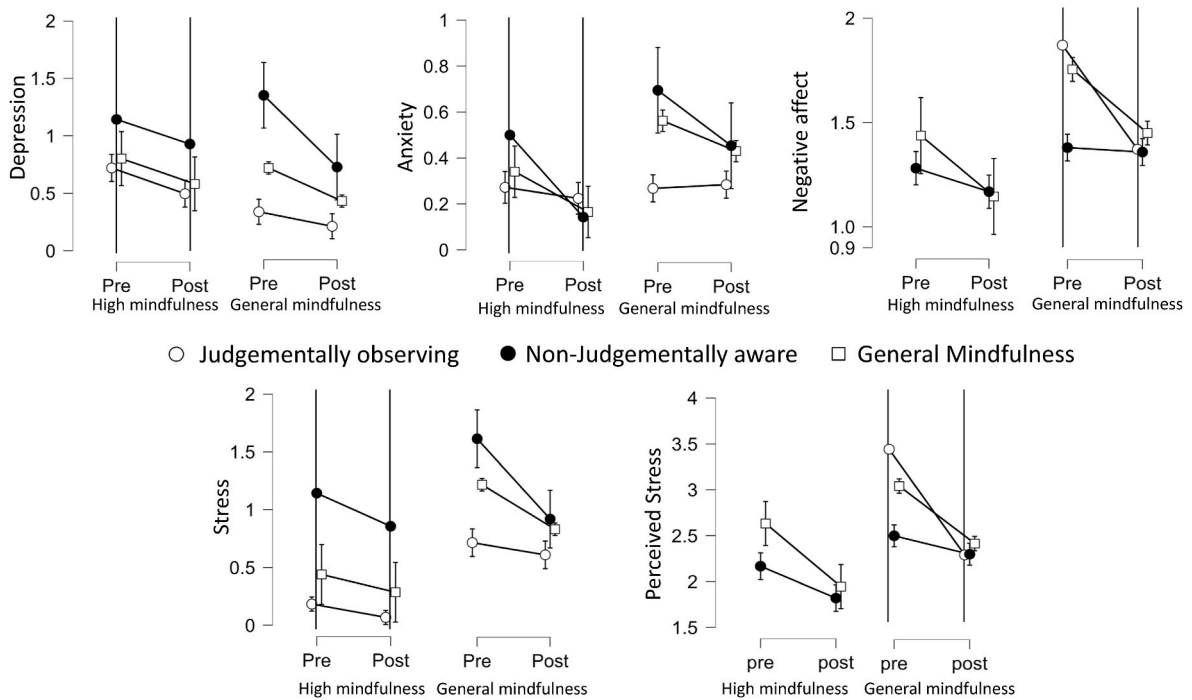


Fig. 5. Mosaic plot representing the contingency table of mindfulness profiles pre and post-MBSR.

**Note** Percentages are by row; Non-Jud Aware = Non-Judgmentally Aware; Jud. Obs = Judgmentally Observing; High = High Mindfulness; General = General Mindfulness. Note that the General Mindfulness profile pre-MBSR is not exactly the same as the one in post-MBSR.

increased their Acting with Awareness and Non-Reacting, while already displaying high levels of Non-Judging. However, participants from this profile who shifted to the General Mindfulness profile showed decreases in Non-Judging, and non-significant changes in Acting with Awareness.

Finally, the General Mindfulness profile pre-MBSR showed expectable patterns, without much differences between “upgraders” to High Mindfulness or “stayers” in General Mindfulness post-MBSR. In addition, means tended to be more proximate between each other, suggesting a cumulative pattern towards an overall mindfulness behavior. It is worth noting that the most pronounced increases were in Non-Judging and Acting with Awareness, which could be explained by the specific contents of MBSR.

#### 4.2. Profile changes across MBSR – external variables

Participants show increases in mental health (self-compassion, decentering, positive affective states, well-being) and decreased ill-being (psychopathology, negative affective states, perceived stress). This is compatible with the literature about the efficacy of MBSR (Creswell et al., 2019; Slemp et al., 2019; van Agteren et al., 2021; Wielgosz et al., 2019). In all cases, the General Mindfulness profiles showed this pattern, with unclear evidence for “upgraders” to High Mindfulness.

The Judgmentally Observing profile showed non-significant or small improvements. Therefore, the MBSR seems limited in its impacts to this group beyond mindfulness facets. This could be explained as the Judgmentally Observing profile being already highly functional in this sample, but a low sample size could also play a role. The Non-judgmentally Aware profile showed increased self-compassion, decentering, positive states, and well-being, regardless of their profile post-MBSR. Also, significant decreases were present in depression, stress, and perceived stress, but with differences between their profiles post-MBSR. Therefore, the MBSR seems to significantly impact this latent profile, increasing their mental health, but it was less clear for decreasing their mental ill-being.

In conclusion, the FFMQ has presented relevant and heterogeneous latent profiles in its psychometric properties that dissipate after mindfulness training. Therefore, the MBSR seems to “sort” or “arrange” participants’ responses in a more homogeneous fashion. Although this explains the previous lack of fit of the FFMQ’s latent models, it is a psychometric challenge that limits scalability. This means that applied users should take care when using the FFMQ. We advise considering other instruments with more parsimonious and robust psychometric properties (like the BIMS or the CHIME, discussed below), and if used, prioritize associations with other constructs instead of latent structures.

#### 4.3. Limitations and future studies

This study has some limitations. Participants were recruited as voluntary assistants to the MBSR in the Spanish population; therefore, self-selection bias and social desirability could alter the sample’s representativity. In addition, two different subsamples were implemented in these studies with some observable differences, which could introduce third variables associated with our findings. All instruments were self-reported, exposing our data to same-method inflation bias but could also not capture our tested constructs well, especially mindfulness. Future studies should aim to build or implement improved measurements of mindfulness (e.g., Amir, Ruimi, & Bernstein, 2021; Isbel, Stefanidis, & Summers, 2020; Petranker & Eastwood, 2021; Shepherd, Coifman, Matt, & Fresco, 2016) but also implement theoretical models in their development (e.g., Choi et al., 2021; Lindsay & Creswell, 2017). In addition, mindfulness facets could be explored in other self-report instruments. A possible alternative to the FFMQ is the Balanced Inventory of Mindfulness Skills (BIMS; Padmanabham, Bilgrami, Eisenlohr-Moul, & Van Dam, 2021). Moreover, future studies could also aim for the development and implementation of behavioral instruments

(e.g., the simulated thoughts paradigm or the breath counting task; Ruimi et al., 2022). In addition, our data were recruited from the general population, exposing our findings to ceiling and floor effects in some self-reports. Future studies could explore latent profiles in clinical populations.

Regarding the intervention, our study explored only MBSR and did not control the effects of the facilitator. Future studies could explore if other MBIs produce similar findings and if the characteristics of the facilitator have predictive power. Finally, regarding our analyses, we could not test the 6-facet structure of the FFMQ due to the implementation of the short-form, and we could not converge an LTA model. Future studies could apply the original form of the FFMQ and aim for convergence and fit of a potential LTA model.

#### Ethical approval

All procedures performed in this study followed the ethical standards of Complutense University of Madrid and the Helsinki declaration and its later amendments or comparable ethical standards.

#### Data availability statement

All data, scripts, and supplementary materials are available at the Open Science Framework ([https://osf.io/f627a/?view\\_only=01bcc2b3fda544df942be97b49e9d821](https://osf.io/f627a/?view_only=01bcc2b3fda544df942be97b49e9d821)).

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#### CRediT authorship contribution statement

**Oscar Lecuona:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Carlos García-Rubio:** Writing – review & editing, Resources, Investigation, Conceptualization. **Sara de Rivas:** Writing – review & editing, Resources, Investigation, Conceptualization. **Joana Vidal:** Writing – review & editing, Methodology. **Jennifer E. Moreno-Jiménez:** Writing – review & editing. **Raquel Rodríguez-Carvajal:** Writing – review & editing, Validation, Supervision, Resources, Funding acquisition, Conceptualization.

#### Declaration of competing interest

The authors declare no conflict of interest.

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#### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jcbs.2024.100775>.

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