



# Effects of Quality Practice on a Compassion Cultivation Training: Somatic and Imagery Levels of Analysis

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## Abstract

**Objectives** Compassion-based interventions (CBIs) are effective in promoting mental health. However, the mechanisms through which CBIs produce these positive outcomes are not fully known. The amount of meditation practice in CBIs has been associated with the outcomes but the role of quality of practice has not yet been explored. Thus, in addition to examining the contribution of the Compassion Practice Quality Scale (CPQS) to predicting the main outcomes of a CBI (compassion cultivation training), the current study explored the scale's construct validity and sensitivity to change.

**Methods** Data were drawn from a pretest–posttest study design ( $n = 74$ ), and compassion practice quality, positive self-compassion, negative self-compassion, difficulties in emotion regulation, and body awareness were assessed.

**Results** The CPQS was found to be a valid and reliable measure, showing pretest–posttest differences. Overall, CPQS baseline scores were positively associated with positive self-compassion and body awareness and negatively associated with negative self-compassion and difficulties in emotion regulation. Moreover, compassion practice quality explained a significant amount of variance in positive self-compassion ( $\Delta R^2 = .18$ ,  $\Delta F(4, 31) = 2.69$ ,  $p = .049$ ), after controlling for baseline positive self-compassion, previous meditation experience, and frequency of formal practice during the CBI.

**Conclusions** The findings confirm the significance of compassion practice quality and the usefulness of the CPQS in compassion research. Future studies should continue to investigate the psychometric properties of the CPQS, describing the daily or weekly evolution of compassion practice and developing specific pedagogical strategies to foster compassion practice quality within CBIs.

**Keywords** Compassion-based interventions · Meditation · Compassion cultivation training · Compassion practice quality · Self-compassion

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In the past 20 years, research on compassion has grown rapidly, showing that increased trait or state compassion is associated with a number of benefits for physical and mental health and social relationships (Goetz et al., 2010; MacBeth & Gumley, 2012; Yarnell and Neff, 2013). Compassion can be defined as “the feeling that arises in witnessing another’s suffering and that motivates a subsequent desire to help” (Goetz et al., 2010, p. 351) and it is described as a trainable skill through meditation practice (Jazaieri et al., 2013). Self-compassion can be understood as the same compassion defined above, but applied to oneself, including the dimensions of treating oneself with kindness, recognizing one’s shared humanity and being mindful about oneself (Neff, 2011). Given the benefits associated with compassion, several compassion-based interventions (CBIs) have been developed to cultivate it in diverse contexts (Ferrari et al., 2019; Kirby et al., 2017a; Skwara et al.,

2017; Wilson et al., 2019). CBIs have been extensively used in physical and mental health-related settings, showing positive outcomes in oncology patients (Gonzalez-Hernandez et al., 2018; 2021), borderline personality disorder (Feliu-Soler et al., 2016), fibromyalgia (Montero-Marín et al., 2017), and self-regulation of various health behaviors (Biber & Ellis, 2019), in the well-being of healthcare clinicians (Sinclair et al., 2016) and in depression of medical students (Mascaro et al., 2018), among other applications. Overall, evidence has shown that these interventions are effective in increasing empathy, compassion, self-compassion, mindfulness, and well-being (Brito et al., 2018; Kirby et al., 2017a), as well as in decreasing psychological distress (Kirby et al., 2017a) and non-adaptive emotional regulation strategies (Roca et al., 2021a). Furthermore, relatively short periods of compassion practice and/or CBIs have shown measurable psychobiological effects, including increased heart rate variability, increased brain activity, and/or increased cortical thickness in frontal and subcortical regions (Kim et al., 2020; Kirby et al. 2017b; Klimecki et al., 2014).

Although CBIs have been a major focus of research recently, efforts should now be directed to identifying the key mechanisms of action of these interventions, in order to optimize their efficacy and acceptability (Kirby et al., 2017a; Roca et al., 2021b). CBIs include several components depending on the program and the model behind it, where in general the key elements are psychoeducation of empathy and compassion, and the practice of different compassion-based meditations (CBMs) (Kirby, 2017). Furthermore, just as the practice of attentional meditation is fundamental in mindfulness-based interventions (MBIs, Birtwell et al., 2019), the practice of compassionate meditation is also a central ingredient in CBIs. For instance, the amount of meditation practice in CBIs has been associated with the development of compassion and emotional regulation skills (Jazaieri et al., 2013, 2014). In the case of mindfulness meditation, the empirical evidence about the effects of practice time is not entirely conclusive, although it has been suggested that the quality of mindfulness practice (rather than the quantity) may be a stronger predictor of positive outcomes (Del Re et al., 2013; Goldberg et al., 2020). Del Re et al. (2013) developed a two-factor measure of the quality of mindfulness practice in a MBI (with receptivity to experience and present-moment attention as the factors), showing that the change in the quality of practice was associated with improvements in psychological symptoms and functions, acting as a mechanism that links the practice time to psychological outcomes (Goldberg et al., 2020). Despite this, most MBI studies have prioritized the quantitative monitoring of practice, and a similar situation can be found in CBI studies, where the quality of compassion practice is often ignored.

Given that the elements that account for the quality of a CBM are different from those of a mindfulness practice, Navarrete et al. (2021a) reported the initial development and validation of a two-factor measure of the quality of a CBM, called the Compassion Practice Quality Scale (CPQS). The CPQS assesses mental imagery and somatic perception, two critical factors in the quality of compassion practices, which are distinct from the factors previously used to assess the mindfulness quality practice. The authors showed that compassion practice quality significantly explained the improvements in compassion outcomes after a CBM, offering a reliable self-report measure, although further evidence is needed. The questionnaire was also used to study the efficacy of a Compassionate-Embodied Virtual Experience and showed good reliability (Navarrete et al., 2021b).

The current research proposed to go beyond a single CBM and aimed to study the change in compassion practice quality after a CBI, as well as exploring potential key mechanisms of change of the intervention. For this, the first aim was to evaluate the association between quality of practice (CPQS) scores and positive/negative self-compassion, difficulties in emotion regulation, and body awareness; second, to determine the sensitivity of the CPQS scores before and after a CBI; and third, to explore the predictive validity of compassion practice quality in the outcome of a CBI. To do so, the quality of compassion practice, positive and negative self-compassion, difficulties in emotion regulation, and body awareness were measured during the first and last session of a Compassion Cultivation Training (CCT) program (Goldin & Jazaieri, 2017; Jinpa, 2010).

## Method

### Participants

A total of 74 participants enrolled in an 8-week CCT between January 2019 and April 2020. Participants were recruited from a university-associated research institute specializing in MBI and CBIs. Participants' mean age was 48.88 (SD = 10.64; range 21 to 76); 78.3% were women (18.8% were men and 2.9% selected "other"), 91.3% had university education (7.3% secondary and 1.4% primary), and 97.1% were Spanish (2.9% were foreigners). Inclusion criteria were being at least 18 years old and not having any current serious psychological disorder or substance use diagnosed by a professional (e.g., psychotic, bipolar, or substance abuse disorder in active phase).

### Procedure

The study followed a pre-post design and self-selection into the program. Participants were invited to join the

study during the registration phase on the website offering the CCT. Those who agreed to participate completed an online screening questionnaire (including demographics and inclusion criteria), received information about the study (i.e., “study on the psychological effects of meditation practice”), and gave their informed consent. Participants completed an online assessment via Qualtrics (including the outcomes measures) during the week before starting the program (i.e., pre-test) and during the week after its completion (i.e., post-test). Qualtrics reminders were scheduled for the participants who had not completed the questionnaires. Furthermore, after the first week of the program (i.e., participants had to have experience with a CBM in order to answer the questionnaire) and at the end of the last week of the program, participants completed the CPQS, which measured their meditation practice quality. At the end of the post assessment, participants were debriefed on the goals of the study and received an individualized report on their changes in the questionnaires as a token of appreciation for their participation in the study. The study was approved by the Complutense University Ethics Committee (Ref 2016/17–016). Previous data from this project (i.e., data from the same study with the same participants about the effects of CCT interventions in different variables) have been published in Roca et al., (2021a, b).

The CCT (Jinpa, 2010) is an 8-week meditation program designed to cultivate empathy, loving-kindness, and compassion toward others and oneself. The class structure consists of guided meditations, interactive exercises, group discussions, and psychoeducation on each week topic. The CCT consists of weekly 2.5-h face-to-face classes and 30 min of daily home practice (both formal practice and informal compassion practices). A formal practice refers to meditation practice per se, of which there are several forms, for example, meditation on loving-kindness and compassion for a loved one during week 2. An informal practice refers to daily exercises outside of meditation, for example, to observe any challenges to compassion in everyday life or limits to cultivating compassion for others during week 6. During each week, the participants are practicing a specific meditation that is changed from week to week (one formal meditation per week with an audio guide). A detailed description of the program can be found in Goldin and Jazaieri (2017). The program was conducted in groups of 20 participants. Participants received a set of audio files to support their daily practice. The program was implemented by two instructors certified by the Center for Compassion and Altruism Research and Education at Stanford University.

## Measures

The online assessment included study-specific questions on demographics, health data, and prior meditation experience, as well as questionnaires measuring self-compassion, body awareness, emotional regulation, and compassion practice quality. Furthermore, frequency of formal practice during the program was measured at post-intervention.

**Self-Compassion Scale-Short Form (Raes et al., 2011; Garcia-Campayo et al., 2014)** The Self-Compassion Scale-Short Form (SCS-SF) is a 12-item self-report measure designed to assess compassion for oneself. Following recent recommendations about the interpretation and scoring of the scale (López et al., 2015; Muris & Otgaar, 2020), we calculated separate scores for the positive self-compassion (self-kindness, common humanity, and mindfulness) and negative self-compassion (self-judgment, isolation, and over-identified) subscales. In the current study, the Spanish version was used and the internal consistency was good for both subscales between assessment moments, with Cronbach’s  $\alpha$  values ranging from 0.85 to 0.89 and McDonald’s  $\omega$  values ranging from 0.86 to 0.90.

**Multidimensional Assessment of Interoceptive Awareness (Mehling et al., 2012)** The Multidimensional Assessment of Interoceptive Awareness (MAIA) is a 32-item self-report measure designed to assess the ability to notice subtle bodily sensations via eight scales: awareness of body sensations (noticing), the tendency to not ignore or distract oneself from body sensations (not distracting), the tendency to not experience worry about body sensations (not worrying), capacity to regulate attention to the body (attention regulation), awareness of the connection between emotions and body sensations (emotional awareness), emotional regulation through body sensations (self-regulation), the tendency to listen to the body for insight (body listening), and trusting body sensations to help in decision-making (trusting). In the current study, the Spanish version was used and the internal consistency was good, with Cronbach’s  $\alpha$  values ranging from 0.83 to 0.96 and McDonald’s  $\omega$  values ranging from 0.94 to 0.95.

**Difficulties in Emotion Regulation Scale (Gratz & Roemer, 2004)** The Difficulties in Emotion Regulation Scale (DERS) is a 28-item self-report measure designed to assess emotion regulation difficulties through five components: lack of emotional awareness, lack of emotional clarity, non-acceptance of emotional responses, difficulties engaging in goal-directed behaviors, and impulse control difficulties. In the current

study, the Spanish version (Hervás & Jódar, 2008) was used and the internal consistency was good, with Cronbach's  $\alpha$  values ranging from 0.80 to 0.93 and McDonald's  $\omega$  values ranging from 0.92 to 0.93.

**Compassion Practice Quality Scale (Navarrete et al., 2021a)** The Compassion Practice Quality Scale (CPQS) contains 12 items, rated on a scale ranging from 0 to 100, that assess compassion practice quality after a CBM. The scale, originally in Spanish, has a two-factor structure (mental imagery and somatic perception), and scores are obtained by calculating the mean of the items. Participants indicate what percentage of the time their experience reflects each statement (e.g., *During the practice, I had a lot of difficulty constructing the mental image that I was using to generate a state of compassion/self-compassion* for the imagery factor and *During the practice, I noticed feelings of warmth and nurturance in my body* for the somatic perception factor). The imagery factor includes items to evaluate the generating, maintaining, inspecting, and manipulating the mental image used during the CBM. The somatic perception factor includes items to evaluate the perception of somatosensory components of the compassion experience, such as warmth, comfort, and affection. Higher scores indicate greater compassion practice quality. In the current study, the imagery (Cronbach's  $\alpha=0.91-0.93$ ; McDonald's  $\omega=0.93-0.94$ ) and somatic perception (Cronbach's  $\alpha=0.89-0.92$ ; McDonald's  $\omega=0.90-0.91$ ) subscales had good internal consistency.

## Data Analyses

All analyses were conducted with IBM SPSS v26. First, internal consistency was assessed using Cronbach's  $\alpha$  and McDonald's  $\omega$ . Then, Pearson correlations were carried out to explore construct validity by studying the association between baseline scores on the CPQS and the SCS-SF, DERS, MAIA, and frequency of previous meditation practice. Effect size guidelines for interpreting small, medium, and large correlations were 0.15, 0.25, and 0.35, respectively (Gignac & Szodorai, 2016).

Second, repeated-measures Student *t* tests were carried out to analyze the CPQS, SCS-SF, DERS, and MAIA changes after the CCT. Concretely, changes in CPQS were investigated to study the sensitivity to change of the CPQS. Cohen's *d* was calculated to interpret the magnitude of the intervention's effect. Effect size guidelines for interpreting small, medium, and large effects were 0.2, 0.5, and 0.8, respectively (Cohen, 1988). Third, two hierarchical multiple regressions were computed to examine the ability of the CPQS measures (imagery and somatic perception) to predict levels of positive and negative self-compassion (SCS-SF), after controlling for baseline levels of positive and negative self-compassion (respectively), previous

meditation experience, and frequency of formal practice during the intervention. Preliminary analyses were conducted to ensure that there were no violations of assumptions of normality, linearity, multicollinearity, and homoscedasticity. To handle missing data for the CPQS, we only included participants with complete data on the pre- and post-test assessments in repeated-measures Student *t* tests and hierarchical multiple regressions ( $n=39$ ) because we were only interested in the subset of participants that provided a full set of results (Tabachnick & Fidell, 2019). Previously, we conducted a preliminary analysis (IBM SPSS Missing Values Analysis) to examine patterns of missing values and ensure that if cases with missing values were deleted, the sample would not be distorted. In this sense, separate variance *t* tests and Little's MCAR test showed no systematic relationship between missingness on CPQS and any other variables and that data were missing completely at random, respectively.

## Results

### Convergent and Divergent Validity

Table 1 shows Pearson product-moment correlations between baseline scores on the CPQS and the SCS-SF,

**Table 1** Convergent and divergent validity of the CPQS scales

Measure	CPQS	
	Imagery	Somatic perception
<b>SCS-SF</b>		
Positive self-compassion	.32*	.36**
Negative self-compassion	-.32*	-.17
<b>DERS</b>		
Total score	-.49**	-.18
Lack of emotional awareness	-.25	-.14
Lack of emotional clarity	-.34**	-.27*
Non-acceptance of emotional responses	-.42**	-.19
Difficulties engaging in goal directed behaviour	-.40**	-.07
Impulse control difficulties	-.41**	-.07
<b>MAIA</b>		
Noticing	.03	.35**
Not-distracting	.45**	.14
Not-worrying	.36**	.39**
Attention regulation	.20	.32*
Emotional awareness	-.02	.37**
Self-regulation	.21	.38**
Body listening	.23	.36**
Trusting	.40**	

$N=74$ . CPQS Compassion Practice Quality Scale, SCS-SF Self-Compassion Scale-Short Form, DERS Difficulties in Emotion Regulation Scale, MAIA Multidimensional Assessment of Interoceptive Awareness

\* $p < .05$ ; \*\* $p < .01$

DERS, MAIA, and frequency of previous meditation practice. There was a strong positive correlation between positive self-compassion and the two CPQS factors, imagery ( $r = 0.32$ ) and somatic ( $r = 0.36$ ) at pre-test. Higher levels of imagery were also associated with lower levels of difficulties in emotion regulation (DERS;  $r$  ranging from  $-0.34$  to  $-0.49$ ). Overall, the somatic factor was positively associated with different body awareness factors (MAIA;  $r$  ranging from  $0.32$  to  $0.39$ ). Finally, there were no significant correlations with frequency of previous meditation practice, imagery ( $r = 0.11$ ,  $p = 0.475$ ), or the somatic factor ( $r = 0.13$ ,  $p = 0.126$ ). Also, there were no statistically significant associations between CPQS-imagery scores and DERS-Lack of emotional awareness ( $r = -0.25$ ), MAIA-noticing ( $r = 0.03$ ), MAIA-attention regulation ( $r = 0.20$ ), MAIA-emotional awareness ( $r = -0.02$ ), MAIA-self-regulation ( $r = 0.21$ ), and MAIA-body listening ( $r = 0.23$ ). In this line, the associations between CPQS-somatic scores and negative self-compassion ( $r = -0.17$ ), all DERS scales ( $r$  ranging from  $-0.07$  to  $-0.19$ ; except for DERS-lack of emotional clarity,  $r = -0.27$ ), MAIA-not-distracting

( $r = 0.09$ ), and MAIA-not worrying ( $r = 0.14$ ) were not statistically significant.

### Within-group Differences in the Study Variables

Table 2 shows the descriptive statistics, paired-sample  $t$ -tests, and within-group effect sizes (Cohen's  $d$ ). There was a statistically significant increase in both CPQS factors and in the positive self-compassion and interoceptive awareness scores after the CCT program. These results suggest that the CPQS is sensitive to change. Furthermore, participants' negative self-compassion and difficulties in emotion regulation significantly decreased after the CCT. Cohen's  $d$  showed small-to-large effect sizes for all differences, ranging from  $0.33$  to  $1.09$ .

### Practice Time and Practice Quality Predicting Treatment Outcomes

Table 3 shows the regression coefficients for the hierarchical multiple regression of pre-test positive self-compassion (SCS-SF), previous meditation experience, frequency of formal practice, and practice quality scores on the post-test positive self-compassion. Positive self-compassion pre-test

**Table 2** Means, standard deviations, and paired-sample  $t$ -tests for CPQS and main outcomes

	Time 1 M (SD)	Time 2 M (SD)	$t_{(38)}$	$p$	Cohen's $d$
Imagery (CPQS)	68.89 (22.04)	76.97 (16.60)	-2.31	.027	0.33
Somatic perception (CPQS)	49.15 (22.69)	62.10 (21.15)	-3.21	.003	0.50
Positive self-compassion (SCS-SF)	19.51 (4.38)	23.38 (4.22)	-5.40	.000	0.46
Negative self-compassion (SCS-SF)	17.13 (5.18)	11.54 (4.15)	7.45	.000	1.09
Difficulties in emotion regulation (DERS)	52.65 (15.28)	45.86 (11.56)	-4.03	.000	0.45
Interoceptive awareness (MAIA)	3.44 (0.68)	3.78 (0.56)	3.04	.004	0.62

$n = 39$ . CPQS Compassion Practice Quality Scale, SCS-SF Self-Compassion Scale-Short Form, DERS Difficulties in Emotion Regulation Scale, MAIA Multidimensional Assessment of Interoceptive Awareness

**Table 3** Regression coefficients for previous meditation experience, frequency of formal practice, and CPQS on SCS-SF (positive self-compassion subscale)

Scales	B	Model			$R^2$	$\Delta R^2$
		SE B	$\beta$	$p$		
Step 1					.23	.23*
Pre-test positive self-compassion (SCS-SF)	0.34	0.14	0.35	.019		
Previous meditation experience (1 = no; 2 = yes)	4.30	3.04	0.29	.167		
Step 2					.30	.07
Frequency of formal practice	1.39	0.59	0.34	.025		
Step 3					.48	.18*
First CBM-Imagery (CPQS)	-0.01	0.03	-0.03	.831		
First CBM-Somatic perception (CPQS)	0.02	0.03	0.08	.597		
Last CBM-Imagery (CPQS)	-0.06	0.04	-0.24	.179		
Last CBM-Somatic perception (CPQS)	0.08	0.03	0.42	.011		

SCS-SF Self-compassion Scale-Short-form, CBM compassion-based meditation, CPQS Compassion Practice Quality Scale. \* $p < .05$

**Table 4** Regression coefficients for previous meditation experience, frequency of formal practice, and CPQS on SCS-SF (negative self-compassion subscale)

Scales	Model					$\Delta R^2$
	B	SE B	$\beta$	p	R <sup>2</sup>	
Step 1					.41	.41***
Pre-test negative self-compassion (SCS-SF)	0.43	0.10	.53	.000		
Previous meditation experience (1 = no; 2 = yes)	- 8.67	2.70	-.47	.003		
Step 2					.45	.04
Frequency of formal practice	- 1.09	0.52	-.26	.044		
Step 3					.58	.13
First CBM-Imagery (CPQS)	- 0.01	0.03	-.04	.773		
First CBM-Somatic perception (CPQS)	- 0.01	0.02	-.06	.652		
Last CBM-Imagery (CPQS)	0.06	0.04	.26	.109		
Last CBM-Somatic perception (CPQS)	- 0.07	0.03	-.33	.024		

SCS-SF Self-compassion Scale-Short-form, CBM compassion-based meditation, CPQS Compassion Practice Quality Scale. \*\*\* $p < .001$

scores and previous experience with meditation practice were entered in step 1, explaining 22.7% of the variance in post-test positive self-compassion ( $F(2, 36) = 5.30, p = 0.010$ ). Then, frequency of formal practice was entered in step 2 and explained an additional 6.8% of the variance ( $F(3, 35) = 4.89, p = 0.006$ ). After entering the CPQS factors in the third step, the total variance explained by the model as a whole was 47.7% ( $F(7, 31) = 4.04, p = 0.003$ ). Thus, the CPQS factors explained an additional 18.2% of the variance in positive self-compassion after controlling the rest of the variables. In the final model, the somatic perception experience during the last meditation of the intervention was a statistically significant predictor, with a higher beta value ( $\beta = 0.42, p = 0.011$ ) than the frequency of formal meditation practice ( $\beta = 0.34, p = 0.025$ ).

Table 4 shows the regression coefficients for the hierarchical multiple regression of pre-test negative self-compassion (SCS-SF), previous meditation experience, frequency of formal practice, and CPQS scores on post-test negative self-compassion. Negative self-compassion pre-test scores and previous experience with meditation practice were entered in step 1, explaining 40.9% of the variance in post-test negative self-compassion ( $F(2, 36) = 12.47, p < 0.001$ ). Then, frequency of formal practice was entered in step 2 and explained an additional 3.8% of the variance ( $F(3, 35) = 9.45, p < 0.001$ ). After entering the scores for the CPQS factors, the total variance explained by the model as a whole was 58.2% ( $F(7, 31) = 6.16, p < 0.001$ ). Thus, the CPQS factors explained an additional 13.5% of the variance in negative self-compassion after controlling the rest of the variables. In the final model, the somatic perception factor from the last meditation performed was a statistically significant predictor, with a higher beta value ( $\beta = -0.33, p = 0.024$ ) than the frequency of formal meditation practice ( $\beta = -0.26, p = 0.044$ ).

## Discussion

The objective of the present research was to study the change in compassion practice quality (measured with the CPQS) after a CBI, first, evaluating the association between the CPQS scores and the outcomes of a CBI, second, determining the sensitivity of the CPQS scores before and after the CBI and third, exploring the predictive validity of compassion practice quality in the outcome of the CBI. Overall, baseline scores on the CPQS were positively associated with positive self-compassion (SCS-SF) and body awareness (MAIA) and negatively associated with negative self-compassion (SCS-SF) and difficulties in emotion regulation (DERS). Specifically, the greater the difficulties with emotion regulation, the more difficulty the participants had in generating, maintaining, inspecting, and manipulating

mental imagery (the imagery factor) in the first CBM of the training. This result is in line with literature about the relationship between mental imagery and emotion (Holmes & Mathews, 2005). Mental imagery may have a powerful and amplifying influence on emotion via (1) a direct impact on the brain's emotional systems, (2) an overlap with perception processes, and/or (3) the recall of past emotional episodes (Holmes & Mathews, 2010; Saulsman et al., 2019; Wilson-Mendenhall et al., 2022). In general, in the first phase of a CBM, participants have to imagine and contemplate a beloved, neutral, or hated person for whom they wish to feel direct compassion (Hofmann et al., 2011). Therefore, a possible explanation for our finding is that this process of mental imagery evokes and amplifies emotions that individuals who have great difficulties in regulating emotions are not able to cope with, thus compromising the quality of the practice. In fact, these meditation exercises involve constant awareness of the emotional state in the body, which might trigger insight and a compassion outcome (Hofmann et al., 2011). Furthermore, emotional dysregulation could be also related to a self-criticism tendency, a factor that has been identified as an important barrier in CBI (Navarrete et al., 2021a, b).

In this line, results showed that a greater ability to notice subtle body sensations (noticing subscale of MAIA) was associated with the somatic factor of the CPQS, which measures a higher perception of somatosensory components of the compassion experience, such as warmth, comfort, and affect. However, the tendency to focus on and worry about painful body sensations (not-distracting and not-worrying subscales of MAIA) was significantly related to the imagery factor of the CPQS, and not to somatic perception. This aspect seems incongruent, taking into account the correlational pattern of the rest of the body awareness factors. For instance, awareness of body sensations and attention regulation (attention regulation and emotional awareness subscales of MAIA) were significantly related to the somatic factor. Those factors measure the tendency to ignore or distract and feel emotional distress or worry with sensations of pain or discomfort. A potential explanation could be that those measures are more related with how we relate to the body (for example, through self-criticism) and the cognitive efforts to avoid experiences, which could be generating more cognitive load.

Moreover, the change of compassion quality practice from the first to the eighth week of a CBI has been investigated, allowing us to evaluate the sensitivity of the CPQS before and after an intervention. Taking into account the first and last meditation experiences during a CBI program, the results showed that the quality increases throughout the training, meaning that the CPQS is sensitive to change. It should be noted that baseline scores on the quality of

practice (CPQS) were not related to previous meditation experience, and so the specific compassion training, including pedagogy, and psychoeducational aspects taught in a CBI (in this case the CCT) might be facilitating these improvements in quality practice. Given that the interventions include several elements and not only CBM, we cannot determine how the context of the CBI or the isolated elements (meditation practice, pedagogy and psychoeducation, group discussions, exercises) may have affected the results.

Finally, scores on the quality of practice (CPQS) explained a significant amount of variance in the positive self-compassion outcome (SCS-SF), after controlling for the frequency of formal practice and meditation experience prior to the CBI. That is, participants whose scores on the CPQS were higher at both the beginning and end of the CBI showed the largest improvements in positive self-compassion. Similar results were found in the study of mindfulness practice quality as a predictor of MBI post-treatment and follow-up psychological functioning, which was an outcome of the intervention (Goldberg et al., 2014). Furthermore, participants' perception of somatosensory components of compassion (somatic perception factor of CPQS) in the last CBM was an independent predictor of the main outcomes. Therefore, these findings corroborate the results presented in Navarrete et al. (2021a) about the usefulness of the CPQS as a predictor of compassion training outcomes. In that study, compassion practice quality was a predictor of state compassion after a CBM. Our results go further and suggest that the quality of practice (CPQS) also predicts CBIs' main outcomes, even after controlling for frequency of practice. According to our results, somatic perception has more impact than mental imagery in CBMs to generate self-compassion, which is in line with that proposed by other authors who state that imagination is not as important as what is experienced (Gilbert & Simos, 2022).

## Limitations and Future Research

Our study has several limitations. For instance, the factor structure of the CPQS was studied with a sample of university students while the current sample was more heterogeneous. Compassion practice quality was only measured twice, instead of assessing it at small time intervals throughout the intervention. Related to this, compassion practice quality is a state variable, so that many other factors might explain the improvement between assessment times. The daily or weekly evolution of compassion practice quality should be specifically studied in CBIs, one possibility is by using experience sampling methods. In addition, more than half of the post-test CPQS data were missing, which may have decreased the statistical power of the analyses. In this regard,

putting sociodemographics and DERS and MAIA scores as well would have enriched the regression models. However, the sample size would not have been enough to include that number of predictors (Tabachnick & Fidell, 2019). Moreover, the sample consisted of college-educated women, thus limiting the generalizability of the results. Finally, this study is not exempt of common method bias in research based on self-reported measures, i.e., the presence of any artifactual covariance as a result of measuring different constructs using the same medium, common scale formats, and scales length, among others (Podsakoff et al., 2012). Future studies should include more participants and importantly a more diverse sample. Additionally, compassion was only measured with the SCS-SF, which focuses on compassion toward the self, excluding compassion for others, which is another main outcome of the CBI that should be tested too. Future studies should continue to investigate psychometric properties of the CPQS, e.g., confirming the factor structure within different populations and studying measurement invariance in expert and novice meditators. Finally, specific pedagogical strategies should be investigated to foster compassion practice quality as early as possible in the context of CBIs, such as emphasizing somatic perception of feelings of warmth and compassionate affection.

In sum, the results of the article help us to understand potential key mechanisms that could explain and predict the response and effects of a CBI and confirm the significance of compassion practice quality in addition to frequency and the usefulness of the CPQS in compassion research, providing better ways to measure working mechanisms of CBMs and CBIs.

**Author Contribution** All the co-authors contributed to the design of the study. PR performed the recruitment. JN, PR, and AC conducted the formal analyses and wrote the method and results sections. CA wrote the original draft and JN, PR, RB, and AC significantly contributed to the discussion section. CA, JN, and AC and collaborated in the writing and editing of the final manuscript. All the co-author approved the final version of the manuscript for submission.

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**Data Availability** All data are available at the Open Science Framework ([https://osf.io/84f2z/?view\\_only=f80186dc5a1c491db10b1fb8373ec0e8](https://osf.io/84f2z/?view_only=f80186dc5a1c491db10b1fb8373ec0e8)).

## Declarations

**Ethics Approval** All the studies were approved by the Complutense University of Madrid Ethics Committee (Ref 2016/17–016).

**Informed Consent** Freely given, informed consent to participate in the studies were obtained from participants.



**Conflict of Interest** The authors declare no competing interests.

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