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Elucidating the role of mind–body connection profiles in emotional reactivity and regulation amongst typically developed adults

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Abstract

Background Adaptive emotional functioning necessitates a strong mind–body connection. The 13-item Body-Mind Connection Questionnaire (BMCQ) was developed to measure attention directed to sensations (Interoceptive Attention), identifying and describing sensations associated with emotions (Sensation-Emotion Articulation), and beliefs regarding mind–body integration and wellbeing (Body-Mind Values). This study aimed to (1) confirm and refine the BMCQ in a new sample of typically developed adults through confirmatory factor analysis (CFA), (2) identify distinct mind–body connection profiles through latent profile analysis (LPA), and (3) explore the impact of these profiles on emotional reactivity and regulation.

Methods Data were collected from 401 typically developed adults from English-speaking countries, registered with Inquisit, with and without self-reported psychological disorders, aged 18 to 50 (M_{age} = 30.62, SD_{age} = 7.98), who completed the BMCQ and the Multidimensional Emotion Questionnaire, assessing frequency, intensity, persistence, and regulation of positive and negative emotions, via an online survey.

Results The CFA led to removal of three BMCQ items in the sample with no disorder, confirming a three-factor model with good fit (CFI: .98, TLI: .98, GFI: .97, RMSEA: .05, RMR: .08) observed, and reliable internal consistency for the scales (α = 0.70 to 0.82), resulting in the BMCQ-10. LPA in the pooled sample revealed three mind–body connection profiles: Strong Mind–Body Connection, Weak Mind–Body Connection, and Mind–Body Disconnection. The Strong Mind Body Connection profile reported more frequent, intense, and persistent positive emotions and found regulating positive and negative emotions the easiest. Conversely, the Weak Mind–Body Connection profile reported less frequent, intense positive emotions, and greater regulation difficulties. The Mind–Body Disconnection profile reported the least intense positive emotions and, with a psychological disorder present, found regulating emotions easier than both the Strong and Weak profiles.

Conclusions The refined BMCQ-10 holds promise as an efficient measure of salient mind–body connection constituents. Findings underscore the nuanced, significant within-group variability that exists amongst mind–body connection beliefs, emotional reactivity, and ease of regulating emotions. Targeted interventions for persons with particular mind–body connection profiles (for example, mindfulness) may be effective avenues for enhancing adaptive beliefs

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which may promote the cultivation of positive emotions and improve emotion regulation in clinical and non-clinical groups.

Keywords Interoception, Alexithymia, Mind–body connection, Individual differences, Emotional reactivity, Emotion regulation

Introduction

At their core, emotions enable us to make meaningful sense of our internal and external experiences. They are generally conceptualised as psychological states involving subjective experiences, physiological changes, cognitions, and expressive behaviours [1, 2]. Davidson [3, 4] proposed that emotional responses comprise related but distinguishable components. Specifically, individuals may differ with respect to (1) the relative ease of emotional response activation—i.e., the threshold required for an emotional response to be elicited and the rate of arousal levels reaching peak amplitude, thus determining the *frequency* of emotional responses, (2) the *intensity* of an emotional response, and (3) the *duration* of an emotional response—i.e., the length of time required for arousal levels to return to baseline. Such components acknowledge the chronometric nature of emotions and are collectively termed 'emotional reactivity' [3, 5]. Adaptive emotional functioning entails generating goal-appropriate, timely, and contextually proportionate responses, contrasting with inadequate, maladaptive reactivity, characterised by emotional hyper- and hypo-reactivity. Maladaptive emotional reactivity contributes to chronic physiological dysregulation, stemming from the misinterpretation of valence and arousal, together with deficits in learning, memory, and attentional deployment to emotional stimuli and bodily sensations [6, 7].

Cultivating positive emotions is shown to have significant momentary and long-term benefits. According to Fredrickson [8], positive emotions play a vital role in the 'broaden-and-build' theory, which suggests that these emotions can facilitate the cultivation of physical, intellectual, and social resources, leading to long-term psychological wellbeing. Moreover, their cultivation can be particularly effective in preventing and treating conditions rooted in negative emotionality, such as depression, anxiety, and stress-related illnesses [9]. Indeed, positive and negative emotions have distinct expressions in the body: positive affectivity is negatively associated with biomarkers indicating chronic dysregulation of homeostatic processes following prolonged, intense activation of stress systems [10], whereas negative affectivity has the opposite effect [11]. Furthermore, longitudinal increases in positive emotionality have been related to lower pro-inflammatory and antiviral gene expression, whereas the inverse has been observed for increased negative emotionality (Rahal et al., 2023).

Emotions are increasingly understood as inexorably involving interoception—the afferent signalling, processing, and neural and mental representation of internal bodily signals [1, 12–15]. Interoceptive sensations are typically experienced consciously as affect—comprising valence and arousal dimensions—and are proposed to form a foundational component of emotional experiences [14, 16]. The synchronous coupling of bodily sensations and emotions promotes the enactment of goal-directed behaviours aimed at restoring or maintaining physiological integrity [1, 14, 15, 17]. In this view, adaptive emotional responses necessitate coherence in detecting, appraising, and categorising body sensations. Interoceptive and emotional dysfunctions (e.g., emotion dysregulation), underlie various clinical conditions, including depression, anxiety, functional disorders, and medically unexplained symptoms [18–21]. As such, they are important mechanisms to consider in the context of a client's presentation. Investigations concerning reactivity for positive and negative emotions, however, have seldom holistically considered beliefs and perceived competencies in mind–body connection processes, including interoceptive attentional deployment and emotional capacities together.

Habitual propensities for being aware of interoceptive sensations and emotional awareness have been found to contribute to emotional reactivity. The quality of adaptive interoceptive attention is conceptualised as reflective of active attention, which adjusts, filters, and augments sensory inputs from the body [22]. By contrast, exaggerated and maladaptive interoceptive attention is driven by hypervigilance or avoidance [23], and related to illness anxiety [24] and somatisation [25]. Evidence further indicates that adaptive interoceptive attentional components and regulatory behaviours are more strongly associated with enhanced identification and description of emotions [26] and positive emotionality [27, 28]. Conversely, reactivity for negative emotions appears related to dysfunctional processing and interpretation of bodily sensations, including maladaptive, hypervigilant interoceptive attention [23, 27], negatively biased reporting [29], and somatosensory amplification [28, 30].

Interoceptive attunement and cognitively valuing interoceptive sensations may also influence the degree to which emotional arousal is perceived. Individuals with positive and neutral interoceptive beliefs and lower sympathetic nervous system (SNS) activity tend to report lower levels of emotional arousal, while those with positive or neutral interoceptive beliefs and greater SNS activity report increased levels of emotional arousal. Contrarily, individuals with negative interoceptive beliefs have reported increased emotional arousal, regardless of whether they experience high or low SNS activity [31]. This suggests that individuals with stronger correspondence between physiological and emotional arousal may be more likely to value and incorporate their physiology into emotional experiences, while those who do not value bodily sensations may ignore or suppress their physiological sensations and rely on external features of the environment to inform their emotional experiences [31]. Similar observations have been made amongst individuals with marked difficulties identifying and articulating emotional experiences, such as those with alexithymia [32]. Persons with high alexithymia struggle to differentiate emotions from sensations, perceiving them as similar—for example, feeling anger as hunger, and vice versa [33], suggesting possible disregard or indifference toward valuing sensations and emotions.

The Body-Mind Connection Questionnaire (BMCQ) is a new 13-item self-report measure of adaptive mind–body connection beliefs [34]. The questionnaire is multidimensional, consisting of three distinct scales assessing the capacity to spontaneously and purposefully direct attention to internal bodily signals (Interoceptive Attention), the ability to identify and describe the link between sensations and emotions, together with internal orientation (Sensation-Emotion Articulation), and beliefs regarding wellbeing and mind–body integration (Body-Mind Values). The BMCQ was developed to facilitate parsimonious measurement of salient mind–body connection constituents by self-report, where preliminary findings indicated differential relationships between BMCQ scales and theoretically related aspects. Specifically, the Body-Mind Values scale was shown to correlate most strongly with Trusting, Body Listening, and Self-Regulation scales from the Multidimensional Assessment of Interoceptive Awareness, Version 2 (MAIA-2; [35]). Moreover, Sensation-Emotion Articulation was positively related to Emotional Awareness and Body Listening scales from the MAIA-2, whereas stronger inverse relationships with alexithymia (difficulties identifying and describing feelings, externally oriented thinking) were shown. Lastly, Interoceptive Attention was most strongly related to Attention Regulation and Noticing MAIA-2 scales. However, several retained questionnaire items demonstrated cross-loading, low primary loadings, and low communalities [34]. The present study scrutinises these items in another sample of typically developed adults. As the BMCQ is a new scale, evidence pertaining to its association with adaptive and maladaptive outcomes is limited. Further exploration of the BMCQ scales could shed light on how distinct mind–body connection profiles may influence the experience of emotions and ease of regulation.

To date, studies have scarcely examined the relation between mind–body connection profiles and emotional reactivity. Yun-Hsin et al. [28] recently did so in a Taiwanese sample using cluster analysis to establish three interoceptive sensibility profiles, according to MAIA dimensions, and examined their effect on emotional reactivity using the Perth Emotional Reactivity Scale (PERS; [36]). A high interoceptive sensibility cluster demonstrated strong awareness of bodily sensations and emotions, and capacities for self-regulation using sensations. A low interoceptive sensibility cluster lacked perceived capacity to attend to bodily sensations and did not self-regulate by drawing attention to sensations. A worrier cluster showed heightened awareness of bodily sensations but experienced worry during discomfort. Results indicated that the high interoceptive sensibility cluster consistently exhibited higher levels of reactivity for positive emotions compared to worrier and low interoceptive sensibility clusters. Conversely, worrier and low interoceptive sensibility clusters reported the highest reactivity for negative emotions. Although the PERS comprehensively assesses emotional reactivity for positive and negative emotions, other scales measuring reactivity for specific emotions exist.

The Multidimensional Emotion Questionnaire (MEQ; 37), like the PERS [36], was developed according to Davidson's [3] emotional reactivity model. Each assess typical experiences of positive and negative emotions according to the separable phases of (1) activation or frequency; (2) intensity; and (3) duration or persistence. Although semantic differences exist with respect to scale labels (e.g., PERS–activation cf. MEQ–frequency), there are discrepancies in how the scales capture this. The MEQ captures reactivity components based on five discrete positive (e.g., happiness, enthusiasm) and five negative (e.g., sadness, anger) emotions. Although some emotions measured by the MEQ overlap with those specified in PERS items, the latter questionnaire lacks specificity in capturing reactivity for individual emotions. Differences also emerge in scale structure and how respondents rate their emotional experiences. The PERS provides indices of emotional reactivity phases by requesting respondents to rate worded items on a 5-point Likert scale ranging from *very unlike me* (1) to *very like me* (5). Conversely, the MEQ is structured to specify discrete emotions, instructing respondents to rate how often, intense, and long-lasting the emotion is typically experienced—assessing frequency, intensity, and persistence phases, respectively. These are also rated on 5-point Likert scales, albeit with more specific response scale anchors—for instance, frequency items range from *about 1 month or less* (1) to *more than 3 times each day* (5)—thereby enabling more granular ratings. Moreover, the MEQ was developed to address limitations of existing reactivity questionnaires lacking assessment of how easy individuals find regulating discrete emotions, which is absent in the PERS. Inclusion of regulation scales in the MEQ is advantageous, as emotional reactivity and capacities for regulating emotions are closely intertwined, interactive processes which shape emotional experiences and responses (6). Heightened reactivity is often more challenging to regulate [37], and poor regulation abilities can lead to intensified, perseverative emotional responses [38]. We deemed the MEQ's scope of discrete emotions, granular chronometry, and regulation items suitable for this study's exploratory purposes.

The purpose of the current study was to confirm the BMCQ in a new sample of typically developed adults through confirmatory factor analysis. The study adopted a person-centred approach by employing LPA which aimed to distinguish mind–body connection profiles based on BMCQ scales, including interoceptive attentional control (Interoceptive Attention), capacities for identifying and describing the link between sensations and emotions (Sensation-Emotion Articulation), and beliefs regarding physical and mental wellbeing (Body-Mind Values). Lastly, the study aimed to examine the emergent latent profiles and their effect on reactivity for positive and negative emotions and emotion regulation outcomes.

Method

Participants

As part of a larger cross-sectional study concerning interoception and emotion, a convenience sample of 401 participants ($M_{age}=30.62$, $SD_{age}=7.98$) from English-speaking countries was recruited for the study through the Prolific recruitment service. To be eligible for inclusion, participants were required to be: aged 18–50, fluent in the English language, reside in Australia, Canada, New Zealand, the United Kingdom, or the United States, and free of a current chronic pain condition (e.g., fibromyalgia). An *a priori* sample size of 260 was deemed an appropriate minimum for validation of the BMCQ, providing a ratio of 20 respondents per item [39]. However, structural equation modelling techniques, (e.g., confirmatory factor analysis) require larger samples to provide reliable and stable estimates (i.e., 200–300 minimum; [39, 40]). Thus, the present sample was deemed sufficient for enhancing statistical power to examine the BMCQ factor structure.

Materials

Body-Mind Connection Questionnaire (BMCQ)

The BMCQ (34) is a 13-item, 3-scale measure that was developed to capture self-reported mind–body connection valuations. Scales include *Body-Mind Values*, consisting of six items related to beliefs in mind–body integration and perceived importance of wellbeing, *Sensation-Emotion Articulation*, comprised of three negatively keyed items involving capacities for identify and describe internal bodily changes in emotional contexts and preference for the internal environment, and *Interoceptive Attention*, consisting of four items capturing the ability to direct attentional resources toward interoceptive stimuli in purposeful and spontaneous manners. Items are rated on a 7-point Likert-scale, ranging from *not at all true of me* (1) to *very true of me* (7). Scores for each scale are obtained by averaging the sum of responses. The preliminary evaluation demonstrated that the BMCQ scales are distinct, and differentially related to self-reports capturing theoretically related constructs including self-reported interoceptive attention and interpretation, and alexithymia. Acceptable to good internal consistency reliability was previously observed for BMCQ scales ($\alpha=0.74$ to 0.85). The 13-item BMCQ administered for cross-validation is available in File S1 of the Supplemental Materials.

Multidimensional Emotion Questionnaire (MEQ)

The MEQ is a self-report measure of emotional experiences, requiring respondents to consider their typical experience of five positive (happy, excited, enthusiastic, proud, inspired) and five negative (sad, afraid, angry, ashamed, anxious) discrete emotions [41]. Participants rate experiences of each emotion on 5-point Likert scales for four facets: (1) Frequency, *'How often?'* ranging from *about once per month or less* to *more than 3 times each day*; (2) Intensity, *'How intense?'*, ranging from *very low* to *very high*; (3) Persistence, *'How long-lasting?'*, ranging from *less than 1 min* to *longer than 4 h*; and (4) Regulation, *'How easy to regulate?'*, ranging from *very easy* to *very difficult*. Qualitative descriptors were converted to numerical values for scoring; nomination of the first descriptor corresponded to a score of 1 and nomination of the last to a score of 5. Summary scores for Frequency, Intensity, Persistence, and Regulation were computed for positive and negative emotions, respectively. Higher scores indicate greater frequency, intensity, or persistence of positive or negative emotions. Frequency, intensity, and persistence facets form components of an Emotional Reactivity factor [3, 41]. For Regulation scales, higher scores indicate greater difficulty regulating positive or negative emotions. Evidence for convergent validity is observed, where MEQ reactivity summary scores strongly correlated with positive and negative affectivity scores from the Positive and Negative Affect Schedule (Positive: $r = 0.72$, Negative: $r = 0.69$). Moderate correlations between the MEQ regulation scales and total scores from the Difficulties in Emotion Regulation Scale were shown (Positive: $r = 0.31$, Negative: $r = 0.42$) [41]. Internal consistency reliability for MEQ facets was good in the present sample (see Table 5).

Procedure

Following ethics approval from the Victoria University Human Research Ethics Committee for a larger study examining interoception and emotion, the study was advertised through Prolific, which included screening for inclusion and exclusion criteria. Interested individuals accessed a survey link for the study that was hosted online using Qualtrics software. After providing informed consent, participants completed a demographic questionnaire and provided information regarding health and lifestyle factors. Then, they proceeded to the questionnaires. Upon study completion, they were remunerated for their participation.

Statistical analyses

To determine whether the 13 BMCQ items conformed to a hypothesised structure and fit the previously identified three-factor model [34] in a new sample of typically developed adults, confirmatory factor analysis (CFA) was conducted using SPSS AMOS, Version 29. Maximum likelihood factoring was employed to estimate the models. Model goodness of fit was evaluated via the χ^2 statistic [42]. Although non-significant χ^2 ($p > 0.05$) is indicative of excellent fit, the test is known to reject models marginally differing from the population structure [39]. We therefore considered additional fit indices, including the ratio of chi-square to its degrees of freedom (CMIN/df), comparative fit index (CFI), Tucker-Lewis index (TLI), goodness of fit index (GFI), root mean square residual (RMR), and root mean squared error of approximation (RMSEA). For absolute fit, CMIN/df values < 3.0 indicate better fit between the model and the data. CFI, TLI, and GFI values ≥ 0.90 were deemed to indicate acceptable fit and values ≥ 0.95 considered as evidence of excellent fit [40, 43]. RMSEA and RMR < 0.08 were judged to indicate acceptable fit and values around 0.05 indicated excellent fit [42]. Internal consistency reliability of the BMCQ scales was evaluated with Cronbach's alpha in SPSS, Version 29. Floor and ceiling effects were assessed, with values between 15–20% of the lowest or highest possible score indicating potential limitations in measurement sensitivity [44]. Inter-scale correlations were assessed through Pearson's bivariate correlations.

Following revision of the BMCQ through CFA, participants' BMCQ subscale scores were analysed through Latent Profile Analysis (LPA) using the TidyLPA package in R-Studio (version 4.3.2). This was conducted to further understand mind–body connection profiles within the sample. Analysis spanned models ranging from two to three profiles to ascertain the most fitting representation of the data. Determination of the optimal model was based on evaluation of several statistical indices, following guidelines proposed by Spurk et al. [45]. We prioritised the model exhibiting lower Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and the Sample-Size Adjusted BIC (SSA-BIC) values, as these metrics are indicative of fit suitability. Moreover, a significant Bootstrapped Likelihood Ratio Test (BLRT) served as a key indicator, indicating that a given model provides a better fit than a model with a single profile where $p < 0.05$. Classification accuracy via entropy values were also considered. Higher figures (i.e., ≥ 0.80) denote a model's precision in categorising participants into distinct profiles, although cut-offs of between 0.60 and 0.80 are also appropriate [45].

In addition to these statistical criteria, emergent latent profiles were inspected through one-way between-subjects analysis of variance (ANOVA) in SPSS to investigate meaningful differences between the mind–body connection profiles across the BMCQ subscales using Welch's F-tests with Games-Howell post-hoc pairwise comparisons, which are robust to heterogenous group variances and unequal groups sizes [46].

Two separate one-way multivariate analysis of covariance (MANCOVA) were also conducted to compare mind–body connection profiles identified via LPA on three dependent variables (DVs) of reactivity for positive and negative emotions (frequency, intensity, and persistence), with self-reported psychological disorder entered as a covariate, as conditions such as depression and anxiety influence emotional reactivity and emotion regulation [6, 38]. To determine whether the mind–body connection profiles affected regulation of positive and negative emotions, one-way between subjects analysis of covariance (ANCOVAs) with self-reported disorder as covariate were planned.

Results

Sample demographics are summarised in Table 1. Overall, the sample endorsed relatively healthy practices and was comparable to the sample included in the original evaluation of the BMCQ [34]. Ninety-two participants

Table 1 Demographic characteristics of the sample ($N = 401$)

Characteristic	*N* (%)
Age	
18–19	19 (4.8%)
20–29	179 (44.8%)
30–39	138 (34.5%)
40–50	64 (16.0%)
Gender Identity	
Male	195 (48.6%)
Female	197 (49.1%)
Another term (e.g., non-binary)	6 (1.5%)
Prefer not to answer	3 (0.7%)
Country of Residence	
Australia	11 (2.9%)
Canada	79 (19.7%)
New Zealand	6 (1.5%)
United Kingdom	286 (71.3%)
United States	19 (4.7%)
Level of Education	
Year 10 or lower	4 (1.0%)
Year 12	152 (37.9%)
Bachelor's Degree	140 (34.9%)
Honours	16 (4%)
TAFE or vocational training	27 (6.7%)
Masters	51 (12.7%)
PhD or Doctorate	5 (1.2%)
Graduate Certificate	6 (1.5%)
Body Mass Index (BMI)*	
Underweight (< 18.5)	10 (2.5%)
Normal (18.5–24.9)	180 (44.9%)
Overweight (25.29.9)	94 (23.4%)
Obese (30 +)	99 (24.7%)
Smoking Status	
Smoker	33 (10.4%)
Non-Smoker	283 (89.6%)
Alcohol Consumption	
0–1 time per week	224 (70.9%)
1–2 times per week	56 (17.7%)
2–3 times per week	19 (6.0%)
3–4 times per week	7 (2.2%)
4 or more times per week	10 (3.2%)
Sport or Exercise Engagement	
Yes	208 (65.8%)
No	108 (34.2%)
Yoga Practice	
Yes	52 (16.5%)
No	264 (83.5%)
Meditation and Mindfulness Practice	
Yes	75 (23.7%)
No	241 (76.3%)
Psychological Disorder*	
Yes	92 (22.9%)
No	309 (77.1%)

* Self-reported

self-reported a current psychological disorder, most commonly comorbid depression and anxiety. For further detail regarding self-reported disorders, see Table S1 of the Supplemental Materials.

Confirmatory factor analysis

Preliminary analyses were conducted to ensure there were no violations of missing data, normality, linearity, homoscedasticity, presence of outliers, and multicollinearity assumptions underlying CFA [39]. Ninety-two participants with self-reported psychological disorders were omitted from analysis, ensuring confirmatory analysis was restricted to a sample comparable to the preliminary evaluation of the BMCQ [34]. This provided a sample of 309 participants. There were no missing BMCQ data. Inspection of standardised residual plots indicated that BMCQ items were linear and normally distributed, and homoscedasticity was assumed, as residuals were equally spread. Ten multivariate outliers were identified and removed from CFA analysis, as they exceeded Mahalanobis' distance ($p < 0.001$). The analysed sample was reduced to 299 participants, providing an appropriate ratio of 23 respondents per item. Correlations between predictor variables were below 0.80, and VIF scores of coefficients below 10, indicating an absence of multicollinearity [39, 47].

As shown in Table 2, CFA results indicated poor fit for the original 13-item BMCQ structure to the data and the initially determined model through exploratory factor analysis was not adequate. Given the poor fit, model modification was considered. Examination of modification indices indicated model misspecification sources—specifically items 3 and 4 from the Interoceptive Attention scale, and items 5, 6, 12 and 13 from the Body-Mind Values scale. Covariance between these error terms were added, which improved model fit, although review of CMIN/df, RMSEA, RMR values indicated that the fit remained poor. Moreover, standardised residual covariances for items 1, 5, and 10 were primarily above 2.0, indicating specification discrepancies [40]. Accordingly, the three items were removed.

Following these modifications, allowing for error terms to covary (item 3–4; item 12–13), the revised model demonstrated good fit compared to the original model, according to CMIN/df, CFI, TLI, GFI, RMSEA, and RMR. One item from the Sensation Emotion Articulation scale (original Item 9 – '*I tend to focus on things happening in my physical environment rather than what is happening inside of me*') had a low factor loading and squared multiple correlation. The item was retained for theoretical purposes based on the involvement of externally oriented thinking in alexithymia [48, 49] and the Sensation-Emotion Articulation construct [34]. Table 2

Table 2 Fit indices for confirmatory factor analyses on the original and refined BMCQ-10 ($N=299$)

CFA	χ^2	*df*	*p*	CMIN/*df*	CFI	TLI	GFI	RMSEA	RMR
Original 13-item BMCQ	329.92	62	<.001	5.32	.84	.80	.85	.12	.14
13-item modified BMCQ	289.99	59	<.001	3.49	.91	.89	.90	.09	.11
Refined BMCQ-10	48.27	30	.019	1.61	.98	.98	.97	.05	.08

CMIN/df chi-square to its degrees of freedom, *CFI* comparative fit index, *TLI* Tucker-Lewis index, *GFI* goodness of fit index, *RMSEA* root mean squared error of approximation, *RMR* root mean square residual

provides model fit indices for original and modified BMCQ models. Table 3 contains standardised factor loadings for BMCQ items according to scale and squared multiple correlations for the refined 10-item BMCQ (BMCQ-10). See File S2 of Supplemental Material for the refined BMCQ-10 following CFA.

Means, internal consistency, item properties, and inter-scale correlations

Score interpretation for BMCQ scales, means, standard deviations, range of observed values, Cronbach's alpha coefficients, and correlations between refined BMCQ scales for the sample with no self-reported psychological disorder are presented in Table 4.

Score interpretations were amended from the original to better reflect retained scale items. Scale scores demonstrated appropriate skewness and kurtosis. Cronbach's alpha ranges remained acceptable to good; however, Sensation-Emotion Articulation reduced from 0.74 in the original assessment [34] to 0.70 due to retention of original BMCQ item 9 (alpha-if-removed = 0.75). In the sample reporting no psychological disorder, ceiling effects were observed in four items, primarily from the Body-Mind Values scale, with 15–20% of responses at the highest scale point, suggesting limited sensitivity in detecting variability at the upper end of the construct (see Supplemental File S3). Regarding inter-scale correlations, the highest correlation was between Interoceptive Attention and Body-Mind Values. As previously observed, positive directionalities were shown, although lower in magnitude [34], indicating greater distinctness between the refined mind–body constructs.

Correlations between measures

Table 5 presents Pearson's correlations between the study measures for the full sample. MEQ reactivity scales (frequency, intensity, persistence) for positive emotions were all significantly correlated, ranging from $r=0.29$ to 0.50. Only positive emotion frequency correlated with regulation of positive emotions. Correlations between MEQ reactivity scales for negative emotions were significant and ranged from $r=0.30$ to 0.56. The negative emotional reactivity scales correlated with regulation of negative emotions. Regarding the BMCQ-10, Body-Mind Values positively correlated with reactivity for positive emotions scales, and negatively correlated with reactivity for negative emotions scales and regulation of positive and negative emotions. Sensation-Emotion Articulation was

Table 3 Standardised CFA factor loadings and squared multiple correlations (SMC) for the BMCQ-10 ($N=299$)

Item	Standardised Factor Loadings			
	Body-Mind Values	Sensation-Emotion Articulation	Interoceptive Attention	SMC
I value being well-balanced in my body and my mind	.754			.568
Feeling mentally well is something that I prioritise in life	.759			.577
Feeling physically well is something that I prioritise in life	.716			.513
I am usually proactive in addressing the needs of my body	.678			.459
I tend to focus on things happening in my physical environment rather than what is happening inside of me.*		.480		.231
If I were asked to, I'd find it hard to describe changes in my body associated with positive or negative emotions.*		.806		.649
I find it hard to identify changes in my body associated with positive or negative emotions.*		.698		.487
It is easy for me to focus on specific sensations if I purposefully think about them			.754	.568
It is easy for me to focus on specific sensations if they are suddenly experienced			.752	.565
I can direct my focus toward how specific parts of my body feel			.815	.664

* Item reverse scored

Table 4 Descriptive statistics for BMCQ-10 scales with Cronbach alphas, scale means, average inter-item correlations, and inter-scale correlations in sample with no self-reported psychological disorder ($N = 309$)

Scale	Score Interpretation	Scale *M* (SD)	Observed Range	Skewness	Kurtosis	BMCQ-10 Cronbach's Alpha	13-item BMCQ Cronbach's Alpha	Average Inter-Item Correlation (BMCQ-10)	Inter-Scale Correlations		
									1	2	3
1. Body-Mind Values	Higher values reflect stronger beliefs in importance of physical and mental wellbeing	5.25 (1.02)	2–7	−0.66	0.23	0.81	0.85	0.52	-		
2. Sensation-Emotion Articulation	Higher values reflect greater internal focus and capacity for identifying and articulating bodily changes associated with emotions	4.18 (1.12)	1–7	−0.08	−0.15	0.70	0.74	0.43	0.36**	-	
3. Interoceptive Attention	Higher values reflect greater deployment of attentional resources toward interoceptive stimuli	5.26 (1.08)	1–7	−1.04	1.76	0.82	0.80	0.61	0.45**	0.35**	-

** $p < .001$

Table 5 Correlations between BMCQ and MEQ scales

Scale	*M (SD)*	Cronbach's Alpha	1	2	3	4	5	6	7	8	9	10	11
1. Body-Mind Values	5.14 (1.06)	0.80	–										
2. Sensation-Emotion Articulation	4.14 (1.18)	0.69	0.31**	–									
3. Interoceptive Attention	5.27 (1.04)	0.80	0.39**	0.34**	–								
4. P-Frequency	12.51 (3.81)	0.79	0.24**	0.10*	0.14**	–							
5. P-Intensity	14.65 (3.19)	0.73	0.22**	0.08	0.21**	0.50**	–						
6. P-Persistence	13.11 (3.28)	0.71	0.12*	0.10	0.20**	0.29**	0.48**	–					
7. N-Frequency	10.73 (3.68)	0.77	−0.25**	−0.10	0.03	−0.05	−0.15**	−0.08	–				
8. N-Intensity	14.04 (3.60)	0.71	−0.13*	−0.06	0.09	−0.16**	0.13*	0.03	0.53**	–			
9. N-Persistence	12.73 (3.51)	0.73	−0.11*	−0.03	0.12*	−0.19**	0.00	0.41**	0.30**	0.56**	–		
10. P-Regulation	11.58 (3.32)	0.72	−0.19**	−0.22**	−0.14**	−0.18**	−0.01	0.00	0.23**	0.24**	0.15**	–	
11. N-Regulation	15.58 (3.84)	0.76	−0.22**	−0.15**	−0.01	−0.26**	−0.03	0.04	0.47**	0.68**	0.48**	0.31**	–

P Positive Emotions, *N* Negative Emotions. Means, standard deviations, and correlations between BMCQ scales: $n = 401$. Means, standard deviations, correlations between MEQ scales and BMCQ scales: $n = 381$

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

positively correlated with positive emotion frequency and negatively correlated with regulation of positive and negative emotions. Interoceptive Attention positively correlated with positive emotional reactivity scales and negative emotion persistence, and negatively with regulation of positive emotions.

Latent profile analysis

To identify mind–body connection profiles within the full sample, inclusive of individuals self-reporting a psychological disorder, participants' BMCQ subscale scores were analysed through LPA ($N=401$). Table 6 displays comparative fit indices derived from the LPA. Models 1 and 2 showed significant BLRT values, indicating superior fit over a single-profile model. Model 2 produced the lowest AIC and BIC values, underscoring more optimal fit when compared to Model 1. A pivotal factor in favouring Model 2 was its classification accuracy, denoted by an entropy value of 0.75, deemed acceptable for signifying precision in participant classification across the models [45]. Accordingly, Model 2, encapsulating three distinct mind–body connection profiles, was determined to be the most appropriate model to represent the present sample. Fig. 1 contains latent profile plots for Models 1 and 2.

Table 7 presents descriptive statistics across the BMCQ subscales, distinguishing three profiles based on their Body-Mind Values, Sensation-Emotion Articulation, and Interoceptive Attention scores, and ANOVA results.

Profile 3 was the most common profile ($n=264$, 65.8%), characterised by the highest Body-Mind Values, Sensation-Emotion Articulation, and Interoceptive Attention scores amongst profiles. This profile indicates a high valuation of physical and mental wellbeing, capacity to identify and describe the connection between their sensations and emotions, an internally oriented focus, and proficient control over attention toward bodily sensations in both purposeful and spontaneous manners. This profile was interpreted as constituting a 'Strong Mind–Body Connection', as such features are collectively suggestive of adaptive mind–body integration perceptions and attitudes [22].

The least common profile—Profile 2 ($n=10$, 2.5%)—was characterised by low Body-Mind Values and Sensation-Emotion Articulation, together with extremely low Interoceptive Attention. Individuals in this profile do not particularly value their wellbeing, may struggle to link and articulate emotions associated with sensations, prefer an external focus, and find it markedly challenging to direct attention to internal bodily sensations. Accordingly, this profile was labelled 'Mind–Body Disconnection'. Despite its small size, retaining this profile is justified by conceptual relevance and empirical precedent [45, 50]. Profile 2 represents a unique subgroup that may struggle with wellbeing, offering insights for targeted interventions. Spurk et al. [45] found that 15.2% of studies retain profiles ranging from 1 to 3%, indicating that inclusion of small, conceptually meaningful profiles is common.

Profile 1 ($n=127$, 31.7%) was characterised by average Interoceptive Attention, relatively low Body-Mind Values, and the lowest Sensation-Emotion Articulation scores amongst profiles. Despite Body-Mind Values appearing moderate when compared to the Strong Mind–Body Connection and Disconnection profiles, they were relatively low compared to sample means (see Tables 4 and 5). Individuals in this profile may perceive themselves as capable of deploying attention toward sensations but struggle to integrate sensory information into their mental representations of emotions. Consequently, they may find it challenging to identify and express the association between sensations and emotions, relying on external factors to inform their emotional experiences and health-promoting beliefs. Despite their capacity for interoceptive attentional control, the condition of their body and mind may not be particularly salient. Given the endorsed interoceptive attentional control, Profile 1 was labelled 'Weak Mind–Body Connection'. Collectively, these traits suggested proneness to alexithymia [25].

Emotion outcomes associated with latent profiles

Table 8 displays descriptive statistics across positive and negative emotion outcomes. Twenty respondents had completely or substantially missing MEQ data and were omitted from analysis. No outliers were identified. Multivariate normality was assumed through inspection of Q-Q plots for each emotional reactivity outcome and consideration of Box's M tests, where $p>0.05$ for both positive and negative emotional reactivity DVs. Homogeneity of variance–covariance matrices was also assumed, according to Box's M tests. Regression slopes were homogenous ($p>0.05$). There was no multicollinearity, as

Table 6 LPA fit indices ($N=401$)

Model	*k*	AIC	BIC	SSA-BIC	BLRT (*p*)	Entropy
1	2	3296.19	3336.13	3304.40	134.77 (.009)	0.64
2	3	3258.44	3314.35	3269.93	45.76 (.009)	0.75

k number of profiles, *AIC* Akaike's Information Criterion, *BIC* Bayesian Information Criterion, *SSA-BIC* Sample-size Adjusted BIC, *BLRT* Bootstrap Likelihood Ratio Test

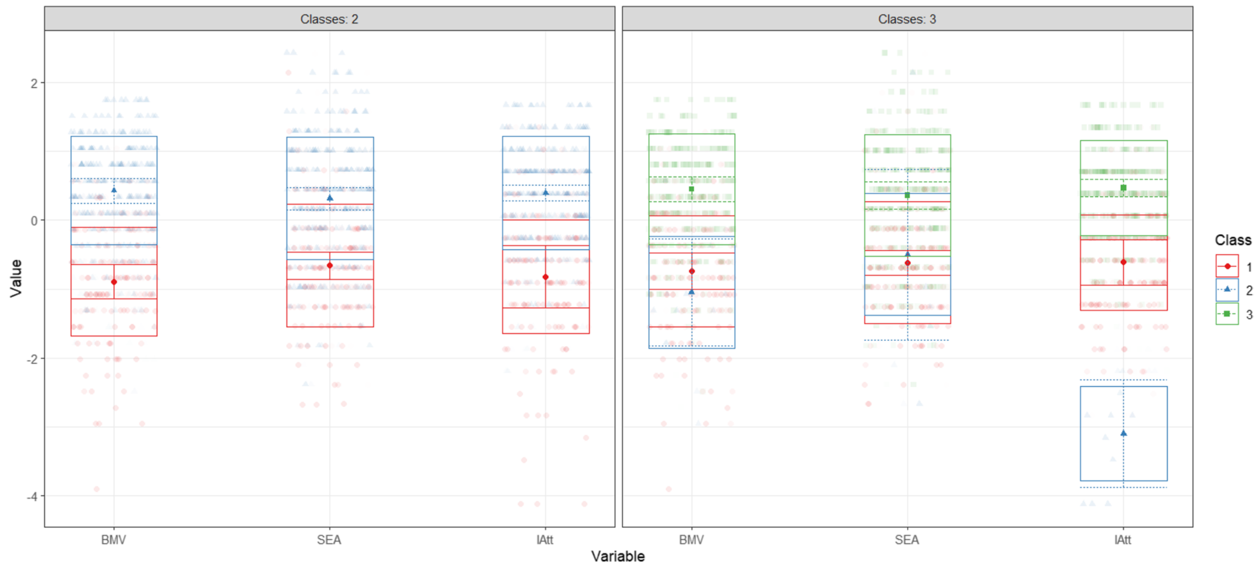

Fig. 1 Latent profile plots for Model 1 and Model 2. Note. Values on the y-axis reflect z-scores. *BMV* Body-Mind Values, *SEA* Sensation-Emotion Articulation, *IAtt* Interoceptive Attention

correlations between DVs were moderate (see Table 5). However, large discrepancies amongst profile membership were noted. Pillai's Trace test is robust to this [39] and was therefore interpreted to explore whether mind–body connection profiles affected reactivity for positive and negative emotional reactivity through two separate one-way MANCOVAs, controlling for self-reported psychological disorder.

Using Pillai's Trace test, the combined reactivity DVs for positive emotions were significantly affected by latent mind–body connection profiles, controlling for self-reported psychological disorder, $V = 0.06$, $F(6,756) = 3.92$, $p < 0.001$, $\eta^2 p = 0.03$. To examine the impact of latent profiles on each emotional reactivity facet, one-way between-subjects ANOVAs, controlling for self-reported psychological disorder, were subsequently interpreted, with Fisher's Least Significant Differences (LSD) post-hoc pairwise comparisons applied, as we had no a priori hypotheses regarding which profiles would differ. Mind–body connection profiles significantly affected positive emotion frequency, $F(2,378) = 4.55$, $p = 0.011$, $\eta^2 p = 0.02$. Post-hoc comparisons using Fisher's LSD tests indicated that individuals with a Strong Mind–Body Connection profile experience positive emotions more frequently than those with a Weak Mind–Body Connection profile, ($p = 0.021$). Positive emotion intensity was also significantly affected by mind–body connection profiles, $F(2,378) = 6.79$, $p = 0.001$, $\eta^2 p = 0.04$, such that the Strong Mind–Body Connection profile typically experience positive emotions more intensely than the Weak Mind–Body Connection profile ($p < 0.001$). Mind–body connection profiles further significantly affected positive emotion persistence, $F(2,378) = 7.43$, $p < 0.001$, $\eta^2 p = 0.04$, wherein the Strong Mind–Body Connection profile experienced positive emotions for longer durations compared to both Mind–Body Disconnection ($p = 0.001$) and Weak Mind–Body Connection profiles ($p = 0.015$). The Weak Mind–Body Connection profile was further found to

Table 7 Descriptive statistics of BMCQ subscale scores for latent profiles

BMCQ Scale	**Profile 1 (Weak Mind–Body Connection) *n* = 127 *M* (*SD*)**	**Profile 2 (Mind–Body Disconnection) *n* = 10 *M* (*SD*)**	**Profile 3 (Strong Mind–Body Connection) *n* = 264 *M* (*SD*)**	**Welch's F-Statistic**	**Significant Games-Howell Contrasts**
Body-Mind Values	4.22 (0.91)	3.90 (0.96)	5.64 (0.76)	120.59**	P3 > P1, P2
Sensation-Emotion Articulation	3.30 (0.90)	3.67 (1.58)	4.57 (1.05)	73.83**	P3 > P1
Interoceptive Attention	4.52 (0.73)	1.93 (0.73)	5.76 (0.65)	234.81**	P3 > P1, P2 P1 > P2

P1 Profile 1, *P2* Profile 2, *P3* Profile 3

** *p* <.001

Table 8 Descriptive statistics of frequency, intensity, persistence, and regulation of positive and negative emotions for latent profiles

Emotion Outcome	**Profile 1 (Weak Mind–Body Connection) *n* = 120 *M (SD)***	**Profile 2 (Mind–Body Disconnection) *n* = 10 *M (SD)***	**Profile 3 (Strong Mind–Body Connection) *n* = 251 *M (SD)***
Reactivity – Positive Emotions			
Frequency	11.87 (3.72)	10.40 (2.83)	12.91 (3.84)
Intensity	13.84 (3.43)	13.50 (1.90)	15.10 (3.03)
Persistence	12.59 (3.45)	10.10 (2.47)	13.47 (3.14)
Reactivity – Negative Emotions			
Frequency	11.41 (3.83)	9.70 (2.98)	10.45 (3.87)
Intensity	14.08 (3.84)	12.90 (2.81)	14.06 (3.51)
Persistence	12.95 (3.89)	10.30 (3.83)	12.70 (3.27)
Emotion Regulation			
Positive Emotions	12.53 (3.46)	12.60 (3.31)	11.09 (3.15)
Negative Emotions	16.36 (3.84)	15.90 (4.43)	15.19 (3.77)

experience positive emotions for longer durations than the Mind–Body Disconnection profile ($p = 0.020$). The combined reactivity DVs for negative emotions were not significantly affected by latent mind–body connection profiles, controlling for self-reported disorder, $V = 0.03$, $F(6,752) = 1.64$, $p = 0.134$.

To explore the effect of latent profiles on regulation outcomes for positive and negative emotions, ANCOVAs controlling for self-reported psychological disorder with Fisher's LSD tests for post-hoc comparisons were planned. Normality, absence of outliers, homogeneity of variance, and normality of residuals were assumed. However, homogeneity of regression slopes was not assumed ($p < 0.05$), indicating that the relationship between regulation outcomes and self-reported diagnosis was different across mind–body connection profiles. The Johnson-Neyman procedure is recommended when this assumption is violated [51] and was applied. As the IV is multicategorical, the Omnibus Groups Regions of Significance tool was utilised, which applies the Johnson-Neyman technique for such variables [52]. Within these analyses, IV categories are set to 0 and form reference groups, enabling comparison with other categories. The dichotomous moderator (M) was psychological disorder status (0 = no disorder, 1 = disorder). Accordingly, this analysis enabled comparison between profiles at each M level. Per suggested interpretation for a dichotomous M [52], Johnson-Neyman boundaries for the effect of profiles on regulation were interpreted at the coded levels of 0 and 1, representing no disorder and disorder, respectively.

Regarding regulation of positive emotions, the model was significant, $F(5,377) = 4.66$, $p = 0.0004$, $R^2 = 0.058$. With Strong Mind–Body Connection as the reference profile, the regression coefficient for the Weak Mind–Body Connection profile was significant ($b = 1.06$, $p = 0.0116$, 95% CI: 0.24, 1.88), indicating that, with no psychological disorder, the Weak Mind–Body Connection profile perceive comparatively greater difficulty regulating positive emotions. No significant differences were found between the Mind–Body Disconnection and Strong Mind–Body Connection profiles in the absence of disorder ($b = 1.03$, $p = 0.351$). The presence of a psychological disorder did not significantly affect regulation of positive emotions for those with a Strong Mind–Body Connection ($b = 0.05$, $p = 0.9172$), indicating disorder does not predict greater difficulties for this profile. Interactions between Weak Mind–Body Connection and M ($b = 1.31$, $p = 0.1137$) and Mind–Body Disconnection and M ($b = 4.84$, $p = 0.1619$) were not significant, suggesting that differences between Strong and Weak and Strong and Disconnection profiles in regulation of positive emotions are not estimated to change in the presence of a disorder. With Weak Mind–Body Connection as the reference profile, the regression coefficient for the Mind–Body Disconnection profile was non-significant in the absence of a disorder ($b = -0.03$, $p = 0.9800$). However, psychological disorder predicted greater difficulty regulating positive emotions in the Weak profile ($b = 1.36$, $p = 0.0389$, 95% CI = 0.07, 2.65). The Mind–Body Disconnection and M interaction was non-significant ($b = 3.53$, $p = 0.3109$), suggesting that the difference between Weak and Disconnection profiles in regulating positive emotions is not expected to change in the presence of a disorder. With Mind–Body Disconnection as the reference profile, the presence of a psychological disorder was not associated with regulation of positive emotions ($b = 4.89$, $p = 0.1531$). Allowing for relationships to covary based on diagnosis explained a further non-significant 1% of variance ($R^2\Delta = 0.010$, $F(2,377) = 2.06$, $p = 0.1290$). The Johnson-Neyman procedure identified no significant bounds; the effect of profiles was significant at both levels of M ($M = 0$: $R^2\Delta = 0.02$, $F = 3.43$, $p = 0.0335$; $M = 1$: $R^2\Delta = 0.03$, $F = 6.68$, $p = 0.0014$), suggesting the effect of profiles on regulation of positive emotions does not vary significantly by diagnosis status.

Regarding regulation of negative emotions, the model was significant, $F(5,376) = 10.24$, $p < 0.0001$, $R^2 = 0.120$. With Strong Mind–Body Connection profile as reference profile, the regression coefficient for Weak Mind–Body Connection was significant ($b = 1.03$, $p = 0.0287$, 95% CI: 0.12, 1.95), indicating that, in the absence of a psychological disorder, the Weak Mind–Body Connection profile reported comparatively greater difficulty regulating negative emotions. No significant differences were found between Mind–Body Disconnection and Strong Mind–Body Connection profiles ($b = 1.97$, $p = 0.1124$). The presence of a psychological disorder predicted greater difficulty regulating negative emotions in the Strong Mind–Body Connection profile ($b = 2.91$, $p < 0.0001$, 95% CI: 1.80, 4.02). The interaction between the Weak Mind–Body Connection profile and M was not significant ($b = -0.26$, $p = 0.7778$), but significant for the Disconnection profile and M ($b = -9.47$, $p = 0.0147$, 95% CI: −17.06, −1.87), indicating that persons with a psychological disorder and Mind–Body Disconnection profile find regulating negative emotions easier than those with a disorder and Strong Mind–Body Connection profile. With Weak Mind–Body Connection as the reference profile, the regression coefficient for the Mind–Body Disconnection profile was not significant ($b = 0.94$, $p = 0.4600$), suggesting that, in the absence of psychological disorders, these profiles do not significantly differ in ease of regulating negative emotions. The presence of a psychological disorder predicted greater difficulty regulating negative emotions in the Weak Mind–Body Connection profile ($b = 2.65$, $p = 0.0004$, 95% CI: 1.20, 4.09). The Mind–Body Disconnection and M interaction was significant ($b = -9.20$, $p = 0.0185$, 95% CI = −16.85, −1.55), suggesting that persons with a psychological disorder and Mind–Body Disconnection profile find regulating negative emotions easier than those with a disorder and Weak Mind–Body Connection profile. With Mind–Body Disconnection as the reference profile, the presence of a psychological disorder was not significantly predictive of regulating negative emotions ($b = 6.56$, $p = 0.0870$). Allowing for covariance based on diagnosis explained an additional non-significant 1.4% of variance ($R^2\Delta = 0.014$, $F(2,376) = 3.01$, $p = 0.0507$). The Johnson-Neyman procedure identified three bounds of significance (0.07, 0.27, 0.63); this was significant for persons with no disorder ($M = 0$: $R^2\Delta = 0.02$, $F = 3.32$, $p = 0.0371$) but non-significant for persons with a disorder ($M = 1$; $R^2\Delta = 0.01$, $F = 2.75$, $p = 0.0654$).

Discussion

With the aim of validating the three-factor structure of the 13-item BMCQ, we employed CFA in a new sample of typically developed adults, which confirmed the hypothesised three-factor structure and led to refinement of the questionnaire, resulting in a condensed 10-item version: the BMCQ-10. Additionally, this investigation sought to examine the association between emergent patterns of mind–body perception using the BMCQ, including the typical experiences of positive and negative emotions and emotion regulation. Employing LPA, three distinct profiles were identified, which best accounted for response pattern probabilities among BMCQ respondents. Furthermore, findings underscored the association between latent mind–body connection profiles and reactivity for positive emotions, and their impact on the ease of emotion regulation.

Confirmation of the BMCQ

Through CFA, the hypothesised three-factor structure of the BMCQ was confirmed in a new sample of typically developed adults, demonstrating good fit, and reduced from 13 to 10 items. Sensation-Emotion Articulation remained an unchanged scale, although internal consistency reliability reduced from 0.74 [34] to 0.70. The original Item 9 from this subscale (*'I tend to focus on things happening in my physical environment rather than what is happening inside of me'*) performed the weakest according to factor loading, contribution to Cronbach's alpha, and low inter-item correlations. Although the item was previously noted to have the lowest extracted communality following exploratory factor analysis [34], it was retained for the BMCQ-10 due to the crucial involvement of externally oriented thinking in alexithymia [48, 49], a theoretical foundation for development of the Sensation-Emotion Articulation scale, which informed generation of the item [34]. Despite this, BMCQ-10 psychometric properties demonstrate relative similarity to those observed in the preliminary assessment. For instance, Cronbach's alpha remained acceptable for Body-Mind Values and Interoceptive Attention scales following removal of two items from the original Body-Mind Values scale (*'I feel disconnected from my body'* and *'Where possible, I always attend to what my body is telling me'*), and one item from the Interoceptive Attention scale (*'I consider myself in touch with my body and mind'*).

Mind–body connection profiles

Prima facie, descriptive statistics shown for BMCQ-10 scales in both the non-diagnosed and pooled samples may suggest homogeneity and minimal score dispersion. Nonetheless, through LPA, three distinct mind–body connection profiles emerged, based on BMCQ scale response patterns within our full sample. This statistically person-centred approach, as applied through LPA, captured the nuances of beliefs in conscious mind–body connection aspects.

One profile pleasingly emerged with the highest levels of Body-Mind Values, Sensation-Emotion Articulation, and Interoceptive Attention, labelled as Strong Mind–Body Connection. This profile, predominant in our sample, exhibited adaptive mind–body connection characteristics, including self-efficacy in attentional control and active responses to sensations, positive values regarding physical and mental wellbeing, and awareness of mind–body integration, exemplified through recognition and verbal expression of physical sensations as components of emotions [22]. Higher interoceptive attention levels in this profile may suggest hypervigilance and maladaptive patterns [25], potentially accompanied by distorted interpretations of bodily sensations [53]. However, given the predominance of this profile, the mean Interoceptive Attention score was close to mean sample values and not vastly different to the mean score when participants with no reported disorder were excluded, suggesting this is unlikely. Furthermore, stronger capacities for identifying and articulating emotions based on such attentional abilities may mitigate tendencies to perceive sensations as disturbing and noxious [30], and engender healthier perspectives on holistic wellbeing [54].

By contrast, the least prevalent profile amongst the sample, labelled Mind–Body Disconnection, displayed the lowest Body-Mind Values and Interoceptive Attention scores, together with low Sensation-Emotion Articulation. Individuals in this profile do not prioritise their physical and mental wellbeing. It is plausible that such perspectives arise from belief in the separateness of mental and physical wellbeing—a characteristic of dualistic beliefs, wherein body and mind are perceived as distinct entities [55]. Within this profile, holding such views may manifest in disconnection from and indifference toward interoceptive sensations, resulting from decreased accuracy and trust in detection of sensory signals, and reduced recognition of the salience of bodily information [32, 56, 57]. Such individuals may rely more heavily on external environmental cues to shape their ongoing affective experiences, rather than integrating physiological sensations with their emotional responses [31, 32]. This reliance could exacerbate the attenuation of bodily information, potentially resulting in vague emotion concepts, and consequently, greater challenges with identifying and articulating emotional experiences for some individuals [34, 58, 59]. It is possible that such characteristics are learned, culminating in employment of coping strategies against unwanted, unpleasant affective or bodily states [60, 61] to protect the self.

The profile characterised as Weak Mind–Body Connection, frequently observed within our sample, tended to endorse capacities for Interoceptive Attention, relatively low Body-Mind Values, and diminished Sensation-Emotion Articulation confidence. Whilst spontaneous and purposeful attention to sensations was present, the co-occurrence of poor emotional capacities and low valuation of wellbeing suggests that this profile is potentially characterised by alexithymic propensities [6, 25, 54, 62, 63]. Reduced emotional identification and expression is argued to arise from difficulty constructing mental representations of emotions [64]. Those with limited emotional capacities due to such challenges are prone to misinterpreting bodily sensations [65] and may perceive of emotions as predominantly physiological phenomena because of a diminished emotion vocabulary and imprecise emotion categories [66–68]. In times of emotional distress, they could misconstrue physical sensations accompanying emotional arousal as indicative of physical illness [64, 69]. Considering this profile's low prioritisation of wellbeing, the potential for heightened interoceptive attention and misinterpretation of physiological sensations also possibly stem from stronger dualistic beliefs.

Mind–body connection profiles, emotional reactivity, and emotion regulation

Latent mind–body connection profiles significantly affected reactivity for positive emotions, indexed by frequency, intensity, and persistence. Previous research demonstrates that components of self-reported interoceptive attention and values positively predict trait positive affectivity [27]. Independently predictive components include awareness of comfortable, uncomfortable, and neutral bodily sensations (MAIA Noticing scale), attention toward normal, non-emotive bodily sensations, prediction of bodily reactions (Body Awareness Questionnaire), and perceptions of the body as safe and trustworthy (MAIA Trusting scale). Notably, these facets have demonstrated moderate to strong relatedness with BMCQ Interoceptive Attention and Body-Mind Values scales [34]. Such capacities are cumulatively suggestive of interoceptive self-efficacy [22, 27]. Positive emotional states may modulate attentional control capacities, enabling individuals to allocate attentional resources to a broader array of stimuli, including those originating from the body [70]. Conversely, stronger, more adaptive attunement with the body and mind may contribute to positive states and overall wellbeing, particularly when individuals perceive their body to be in an optimal condition [22, 27].

Individuals within the Strong Mind–Body Connection profile perceived experiencing positive emotions with greater frequency and intensity compared to those within the Weak Mind–Body Connection profile, as well as experiencing positive emotions more persistently than individuals within Weak Connection and Mind–Body Disconnection profiles. This observation aligns with previous findings suggesting that individuals with high interoceptive sensibility skills exhibit heightened activation, intensity, and prolonged positive emotional experiences [28]. Collectively, such findings indicate that a subjective inclination toward monitoring bodily sensations plays a pivotal role in shaping emotional states, as heightened attention to interoceptive cues during emotional episodes can amplify emotional activation or frequency and intensity [31], particularly in the context of certain positive emotions.

Individuals characterised by Strong Mind–Body Connection are posited to possess propensities for engaging with positive stimuli and experiences, thereby facilitating appetitive behaviour and fostering positive affect in the pursuit of desired goals [3]. Moreover, a strong belief in interoceptive attentional control capacities may augment the coupling between physiological and emotional arousal, with bodily sensations serving as valuable sources of information contributing to emotional episodes [31]. This may support clearer recognition of personal needs, enabling individuals to set and pursue goals that align with their wellbeing. In contrast, higher alexithymia is characterised by inflexible responsivity and indifference to emotional stimuli [6], coupled with deficits in and fear of positive emotions [67, 71]. Collectively, this implies a preference for withdrawal from positive or rewarding stimuli [3]. As such, individuals with alexithymic inclinations—characteristic of the Weak Mind–Body Connection profile—may subsequently exhibit diminished intensity and heightened thresholds for the activation of positive emotions [3, 72].

Relative to Strong and Weak Mind–Body Connection profiles, the observation that the Mind–Body Disconnection profile experienced positive emotions less persistently aligns with their diminished sensory awareness and integration of bodily sensations within emotional experiences [31]. Individuals with such characteristics may encounter difficulties in discerning physiological changes accompanying positive emotions and find it challenging to completely recognise or acknowledge such emotional experiences, resulting in transient emotional episodes that are subsequently disregarded or overlooked. By contrast, higher interoceptive attention may augment the duration of felt positive emotions due to heightened salience and awareness of physiological arousal [73].

Experiencing positive emotions may facilitate a broadening of momentary thought-action repertoires, thereby promoting the expansion of attention and interest in the environment which encourage play and exploration [74]. This broadening of momentary repertoires augments building enduring personal resources [75], whereby resources accumulated through ongoing experiences of positive emotions enable individuals to draw upon a vaster resource reserve during challenging circumstances, thereby enhancing resilience and overall wellbeing. This may further contextualise why individuals with a Strong Mind–Body Connection profile, who are attuned to bodily sensations and prioritise wellbeing, reported frequent, intense, and persistent experiences of positive emotions. Their capacity to detect and sustain such emotions may not only contribute directly to these emotional experiences but also facilitate the ongoing development of personal resources that reinforce wellbeing over time. Conversely, Weak and Mind–Body Disconnection profiles may experience a narrowing of thought-action tendencies and attentional focus directed toward negative emotional states [75]. Consequently, individuals within such profiles may experience lower reactivity for positive emotions due to diminished capacities to perceive bodily signals associated positive emotionality and reduced engagement in wellbeing-promoting behaviours. These characteristics may limit both the emergence and maintenance of positive emotion experiences.

However, latent mind–body connection profiles did not significantly affect reactivity for negative emotions in the present sample. Moreover, we observed weaker correlations between BMCQ scales and MEQ frequency, intensity, and persistence scales for negative emotions when compared to positive emotions. These findings align with evidence indicating that the association between self-reported interoception and negative affectivity is tenuous [27, 62, 76], and that adaptive interoceptive aspects, such as those assessed by the MAIA, are less strongly related to reactivity for negative emotions [28]. Although evidence is limited, individuals with impaired emotional awareness, as observed in high alexithymia, seem to have relatively intact capacities for experiencing and verbally expressing negative emotions [67], which may partially account for this null finding.

Regarding regulation, we found that, in the absence of psychological disorder, individuals within the Weak Mind–Body Connection profile indicated significantly greater difficulty regulating both positive and negative emotions compared to those with a Strong-Mind Body Connection profile. These difficulties can be attributed to the elevated alexithymic characteristics underpinning the profile. Alexithymia restricts the quality of emotional information accessible to individuals, influencing their strategy selection [38, 48]. Our findings complement previous research reliably linking high alexithymia to emotion dysregulation and the selection of maladaptive regulatory strategies, marked by suppression, avoidance, and withdrawal [6, 77]. Inflexible employment of maladaptive strategies can consequently increase physiological activation and responses, due to the effort required for inhibiting ongoing emotional experiences [6, 7, 78].

Application of the Johnson-Neyman procedure revealed that disorder status did not affect the regulation of positive emotions between profiles. This contrasts with evidence suggesting heightened positive emotion dysregulation in disorders such as depression [79] and anxiety [80]. Irrespective of mind–body connection profiles, stronger beliefs in the controllability and usefulness of positive emotions could reduce perceived difficulties in regulating these emotions, as indicated by reduced maladaptive strategy employment (e.g., suppression) and lower depressive and anxious symptomatology [81, 82].

In contrast, the presence of a psychological disorder predicted greater difficulty regulating negative emotions for those with Strong and Weak Mind–Body Connection profiles. Higher interoceptive attention in these profiles may promote maladaptive strategy use (e.g., distraction; [58, 83]), increasing perceived regulation difficulties due to their stronger awareness of physiological changes. Conversely, individuals with a Mind–Body Disconnection and psychological disorder perceived easier regulation of negative emotions when compared to Strong and Weak Mind–Body Connection profiles. Persons with low interoceptive abilities express passivity toward negative emotions and preferences for maladaptive, inefficient regulatory strategies, which enables them to feel less impacted by stimuli and events evoking negative emotions [62]. Additionally, higher alexithymic propensity, observed in the profile, relates to early avoidance and lower allocation of attention to stimuli evoking negative emotionality [84, 85], leading to reduced engagement with negative emotions which may augment perceptions of easier regulation. Moreover, the co-occurrence of alexithymia and lack of insight in psychiatric disorders [86] possibly enhances perceived emotion controllability, reducing the sense of being overwhelmed by unpleasant emotions that are not fully experienced.

The Johnson-Neyman procedure revealed that differences in regulation of negative emotions between profiles are particularly pronounced in the absence of a psychological disorder. Amongst individuals without a psychological disorder, there may be greater variability in levels of external support (e.g., therapy, medication), influencing regulation of negative emotions. In contrast, consistent access to effective treatments might reduce regulation variability amongst those with psychological disorders.

Implications

Persons with lived experience of mental health conditions emphasise the importance of recognising and addressing the mind–body connection to enhance outcomes and wellbeing, highlighting the need to address and improve their emotional reactions [87]. This study introduces a novel classification of distinct mind–body connection profiles, grounded in the salient, verified constituents of interoceptive attentional control, emotional capacities, and health and wellbeing beliefs. These findings therefore hold significant clinical implications, considering the observed influence of such profiles on the frequency, intensity, and persistence of positive emotions, as well as the ease of regulating emotions. Positive emotions are essential contributors to momentary and long-term wellbeing; their cultivation can effectively prevent and treat issues arising from negative emotionality [8, 9]. The present findings offer valuable insight into mind–body connection profiles that either promote or hinder this cultivation.

Mindfulness is an increasingly popular intervention for the treatment of such conditions, which may facilitate flexibility in the use of adaptive cognitive appraisals by enhancing interoceptive attention to sensations [88]. According to the identified latent profiles, interventions targeted at enhancing attention to sensations could benefit individuals with a Mind–Body Disconnection profile. Doing so may support individuals to recognise and value their bodily sensations, providing a basis for incorporating physiological arousal into ongoing emotional experiences [31, 89, 90] and secondarily reduce dualistic views that may reinforce these characteristics.

However, enhancing attention to sensations has the potential to be anxiogenic [91], particularly for individuals exhibiting Weak Mind–Body Connection profile traits. This profile exhibits characteristics reflective of alexithymia, which can affect treatment outcomes for various psychiatric conditions [92], contributes to somatisation [69, 93], and relates to heightened physiological reactivity [7]. In the presence of elevated interoceptive attentional control characterised by hypervigilance, mindfulness-based interventions may seek to initially target maladaptive interoceptive interpretations, encouraging non-judgemental acceptance of sensations [90]. This approach could precede efforts to enhance emotional identification and labelling [94], promoting the cultivation of emotions grounded in adaptive interoceptive interpretations, reducing experiences of somatic symptoms, and fostering healthy wellbeing perspectives and practices.

Interventions should thus consider perceived interoceptive and/or emotion deficits alongside wellbeing attitudes. Addressing these identified barriers to adaptive emotional reactivity and regulation may enhance capacities to cultivate positive emotions with precision and specificity and promote employment of flexible regulatory strategies, thus fostering holistic wellbeing. Accordingly, mind–body researchers and clinicians may seek to screen and monitor changes in mind–body connection perceptions using the BMCQ-10 to assess whether targeted, individualised interventions are effectively cultivating characteristics associated with a strong mind–body connection.

Limitations

Despite these insights, several limitations must be considered. The retention of item 9 from the original 13-item BMCQ affected the internal consistency reliability of the Sensation-Emotion Articulation scale. Revising this item to improve measurement of'internally oriented thinking'within the BMCQ-10 may enhance the scale's construct validity and reliability. Similarly, ceiling effects were observed in four of ten items, with three of these items belonging to the Body-Mind Values subscale. While this suggests potential limitations in sensitivity at the upper end, the emergence of three distinct profiles in the LPA indicates that the subscale captures meaningful variability. Further, test–retest reliability of the BMCQ-10 was not assessed, which remains an important consideration for future investigations. Our sample primarily consisted of relatively young, healthy individuals, offering a preliminary basis for score interpretation following refinement of BMCQ scales. Moreover, as validity was not assessed in psychiatric populations, utilisation of the BMCQ-10 with such cohorts requires caution. Although generalisability is currently limited, the findings illuminate understandings of mind–body connection perceptions within a typically developed sample, giving rise to future investigations within clinical populations. In doing so, the potential influence of prior attentional training (e.g., meditation) on BMCQ responses and subsequent profiles should be considered. Future research could account for this to clarify their impact on mind–body connection profiles, as stronger valuation of the mind–body connection may enhance greater integration of sensations and emotions. Whilst the sample size for CFA and LPA was adequate [42, 50], investigation in larger samples would offer more robust normative references for clinicians. Furthermore, following LPA, a small profile (Mind–Body Disconnection) was identified and retained based on model fit statistics, conceptual relevance, and empirical precedent. However, its small size likely reduced statistical power, limiting detection of its influence on emotional reactivity and regulation. Methodologically, psychological disorder status was a dichotomous variable; the disorder category comprised individuals with heterogenous conditions varying in nature, symptomatology, and severity, thus differentially impacting emotion regulation strategy employment [95]. Moreover, MEQ items measuring regulation (*'How easy to regulate'*) lacked consideration of diverse strategy employment. Future research should examine specific strategy selections within specific conditions.

Conclusion

Our study supports the validity of the BMCQ-10 as a mind–body connection self-report among typically developed adults, reinforcing the notion that salient constituents include interoceptive attentional control (Interoceptive Attention), capacities for identifying and describing the link between sensations and emotions (Sensation-Emotion Articulation), and beliefs regarding physical and mental wellbeing (Body-Mind Values). While future research should focus on improving item clarity and confirming its validity across larger, diverse populations, the BMCQ-10 holds promise as a valuable tool for both mind–body research and clinical applications. To our knowledge, this study is the first to differentiate mind–body connection profiles based on the salient constituents of interoceptive attentional control, emotional capacities, and wellbeing beliefs. This differentiation enabled a holistic, nuanced investigation of how distinct profiles affect the typical frequency, intensity, persistence, and regulation of emotions. The findings underscore the distinct, significant impact of mind–body connection profiles on experiences of positive emotions and the regulation of both positive and negative emotions. This study lays the foundation for investigating how mind–body connection profiles relate to emotional reactivity and regulation in clinical populations, which can inform the development of tailored interventions to cultivate strong mind–body connections and positive emotions that promote adaptive emotional functioning.

Supplementary information

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Supplementary material 1.

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Author contributions
KVB conceived and designed the project, acquired and processed the data, performed analyses, and drafted the article. JS, ES, and MB conceived and designed the project and supervised the work. All authors participated in data interpretation and revising the manuscript critically and gave final approval for the version to be submitted.

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Data availability

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

Declarations

Ethics approval

The study was conducted in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later amendments.

Consent to participate

Ethical approval was obtained from the Victoria University Human Research Ethics Committee (Application ID: HRE21-001). Participants indicated their consent to participate in the study by selecting this option via the survey hosted on Qualtrics. All participants provided informed consent prior to commencing the questionnaires.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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