

Mood as the Mediator of the Relationship Between Interoceptive Sensibility and Alexithymia

Luan Nguyen Huynh, RMIT University Vietnam, Vietnam

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Abstract

Alexithymia is a personality construct characterised by difficulties describing and identifying emotions. Alexithymia was evident to be associated with interoception, the ability to perceive and interpret internal bodily signals. There is a limited investigation on self-evaluated interoceptive sensibility aspect (IS) and its link with alexithymia and covariates. Therefore, the present cross-sectional design established the relationship between alexithymia and IS, assessed by the Multidimensional Assessment of Interoceptive Awareness (W. E. Mehling et al., 2012) and the Body Mindfulness Questionnaire (Burg et al., 2017) (N = 161). The effects of potential covariates were also examined. Our study reported the significant inverse correlation between various aspects of alexithymia and IS. Especially, based on regression models, we proposed and scrutinised “experiencing body awareness” and “trusting body awareness” as fundamental factors of IS in relation to alexithymia. Crucially, the present research claims the mediating effects of depression and anxiety on this relationship. These findings provided the new pathway to understand the interaction between IS, mood and alexithymia, thus shed light on the influence of mindful attention style and trusting attitude in IS as well as the alexithymia subtypes.

Keywords: interoception, alexithymia, body perception, mindfulness, emotion

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Introduction

To date, current researchers have focused on the concept of interoception, the ability to perceive and interpret internal bodily signals. Garfinkel et al. (2015) have defined three distinct types of interoception: interoceptive accuracy (IAcc, ability to perform accurately on objective behavioural measures), interoceptive sensibility (IS, self-evaluation of subjective interoception by using self-report questionnaires or interviews) and interoceptive awareness (metacognitive level of awareness of IAcc or our awareness of our objective performance). Among these concepts, IAcc has gained more attention to be explored with various objective assessment methods (Murphy, Catmur, & Bird, 2017). Besides that, IAcc and IS were known to be distinct, suggesting that these concepts have separate mechanisms and different effects on emotional experiences (Garfinkel et al., 2015). Therefore, it is of notice to examine other facets of interoception to reflect the concept of interoception more fully.

Early theories have linked body perception to emotion and emotional processes. James (1884) stated that the bodily change was a part of the emotional formation. Damasio (1994) proposed the “somatic marker hypothesis”, arguing that visceral states are mapped in different brain areas, which produce images to evoke feeling states. These emotional processes then could guide or bias behavioural outcomes. Damasio (1994) claimed the crucial role of bodily signals for emotions through direct ways or mental representation in somatosensory structures of the brain. Recent empirical findings have confirmed that interoception was significantly correlated with individual’s emotional experience (Critchley et al., 2004; Herbert et al., 2007; Pollatos et al., 2007; Seth, 2013). Subjective feelings rely on the active interpretation of physiological changes on our bodies (Seth et al., 2011).

Body perception was widely known as the significant antecedent of alexithymia. Alexithymia is a personality construct characterized by marked deficits in emotional skills, including three main difficulties in describing and identifying emotions (DDF and DIF, respectively) and externally oriented thinking style (EOT) (Bagby et al., 1994; Sifneos, 1973). Several investigations have reported the negatively predictive effect of interoception on alexithymia in all three facets (Herbert et al., 2011; Shah et al., 2016), emphasizing the role of alexithymia as the marker of poor interoception (Murphy, Brewer, et al., 2017). However, the ability to objectively perceive our bodily signals through the heartbeat perception task cannot solely affect our emotions and behaviours but our interpretation and appraisal of stimuli (Burg et al., 2017; Gross, 2015). Therefore, the role of positive interpretation and appreciating attitude in IS on emotional deficits should be examined.

Various studies have been conducted to conceptualise IS and its related links. Alexithymia was found to positively correlated with poor IS (Brewer et al., 2016; Longarzo et al., 2015; Zamariola et al., 2018). These results suggested that people with high alexithymia were less likely to focus on their body but oversensitive to pain and discomfort. They also lacked self-confident with their bodily cues when not feeling their body as safe and trustworthy. Additionally, as it was evident that alexithymia had strong links with different factors, these variables and their effects should be controlled and examined. These are gender (Herbert et al., 2011), depression (Honkalampi et al., 2000; Marchesi et al., 2000; Parker et al., 1991), anxiety (Karukivi et al., 2010; Marchesi et al., 2000), somatisation (Lipsanen et al., 2004), body dissatisfaction (De Berardis et al., 2007; Hamilton, 2008) but not autistic traits (Shah et al., 2016). Limited studies have attempted to control their effects on the relationship between alexithymia and interoception in regression models (Herbert et al., 2011; Shah et al., 2016). The current study continues to focus on IS and its link with alexithymia by using the

multidimensional scale to deepen the understanding of IS and reassure its predictive effect on alexithymia while taking moods as covariates into account.

Altogether robust evidence has established the strong links between alexithymia and interoception. However, these findings were controversial by the disproportionate use of IAcc tasks and ineffective control of related covariates. Thus, the present study aims to explore the link between IS and alexithymia under the influences of mediating factors. Based on the previous literature it is hypothesized that IS is negatively correlated with alexithymia. It is further hypothesised that the predictive power of IS on alexithymia remains unchanged when depression and anxiety are added.

Methods

Participants

Adult males and females who are eighteen and above were recruited to participate in the online questionnaire ($N = 161$). Data were collected through Qualtrics online system. However, only completed responses were further analysed ($N = 132$). The sample characteristics are presented in the Table 1 and Table 2.

Table 1

Mean and Standard Deviations of Demographic Information

Variable	N	M	SD
Age	132	27.07	10.47
BMI	130	24.22	5.73
TAS-20	132	51.03	13.90
Anxiety	132	16.74	13.04
Depression	130	11.43	11.06
Somatisation	132	22.73	7.62
BMQ	132	51.45	11.38
MAIA	132	21.64	5.16

Note. N = number of participants; M = mean; SD = standard deviation; BMI = Body Mass Index; TAS-20 = Toronto Alexithymia Scale - 20; BMQ = Body Mindfulness Questionnaire; MAIA = Multidimensional Assessment of Interoceptive Awareness

Table 2
Frequencies of Demographic Information

Variable	N	%
Gender		
Male	21	15.9
Female	111	84.1
Language		
English native speaker	81	61.4
Non-native speaker	51	38.6
Current medication usage		
Yes	28	21.2
No	104	78.8

Note. N = number of participants

Procedures

Participants were asked to read the information sheet and agree with the consent form before they proceeded with the survey through an online questionnaire. The questionnaire presented demographic questions first, then showing two body perception tests and one alexithymia battery before ending with three scales measuring possible confounds. All responses were anonymous and were assessed at one-time point.

Measures

Demographics

Data related to age, gender, height, weight, currently used medication and native language was collected at the beginning of the questionnaire.

Toronto Alexithymia Scale (TAS - 20)

Alexithymia was measured using the TAS-20 with three sub-scales, namely, “difficulty describing feelings” (DDF), “difficulty identifying feelings” (DIF) and “externally oriented thinking” (EOT) (Bagby et al., 1994). Each statement was rated from 1 to 5 when higher scores reflect more alexithymia. In this sample, the Cronbach’s alphas for the total scale, DDF, DIF and EOT were 0.89, 0.87, 0.90, and 0.56 respectively. Due to the low reliability, EOT was excluded from further analysis of the present study.

Multidimensional Assessment of Interoceptive Awareness (MAIA)

The 32-item MAIA (W. E. Mehling et al., 2012) was used to assess eight domains of interoceptive body awareness: “noticing”, “not distracting”, “not worrying”, “attention regulation”, “emotional awareness”, “self-regulation”, “body listening” and “trusting”. Higher scores in MAIA indicate better IS. The Cronbach’s alphas for the total scale and all subscales were 0.91, 0.68, 0.65, 0.67, 0.89, 0.86, 0.81, 0.87 and 0.87, respectively. As “noticing”, “not

distracting” and “not worrying” subscales got low reliability scores, they were not further analysed.

Body Mindfulness Questionnaire (BMQ)

BMQ (Burg et al., 2017) was used to measure the concept of body mindfulness, consisting of “experiencing body awareness” (EBA) and “appreciating body awareness” (ABA). BMQ used 6-point Likert-type scale ranging from 1 to 6 when the higher scores indicate better body mindfulness. The reliability of the whole battery and two domains were $\alpha = 0.88$, 0.91 and 0.91, respectively.

Beck’s Depression Inventory (BDI)

The level of depression was assessed by using BDI (Beck et al., 1961). Twenty-one items regarding main depressive symptoms were scored from 0 to 3. Higher scores indicate more intensive symptoms of depression. In the present study, the reliability for this scale was $\alpha = 0.94$.

Beck’s Anxiety Inventory (BAI)

BAI (Beck et al., 1988) was used to measure the severity of anxiety in participants. Twenty-one common symptoms of anxiety were self-assessed from 1 to 4 when higher scores reflect more severe anxiety. The Cronbach’s alpha for this battery was 0.93.

Symptom Checklist 90 - SCL-90 - Somatisation Subscale

Twelve items of somatisation were taken from SCL-90 (Derogatis, 1994) to measure distress arising from perceptions of bodily dysfunction. The severity of these somatic symptoms was evaluated from 0 = not at all to 4 = extremely disturbing during the past week. The reliability for SCL - 90 - Somatisation subscale was $\alpha = 0.83$.

Results

Sample Characteristics

Initially, as the data were not normally distributed, bootstrapping was performed with 1000 samples at the level of 95% of confidence intervals. In this study, independent analysis indicated that there were no significant differences between male and female groups in DDF ($F(1,130) = 0.254$, $p = 0.615$) and DIF ($F(1,130) = 1.711$, $p = 0.193$). Therefore, despite the disproportion of gender frequency, we could combine all responses of the two groups for further analysis. Age was negatively correlated with DDF ($r = -0.249$, 95% CI [-0.415, -0.085]) but not DIF ($r = -0.130$, 95% CI [-0.319, 0.060]). BMI did not have any association with both DDF and DIF ($r = 0.055$ and $r = 0.037$, 95% CIs [-0.107, 0.208] and [-0.142, 0.203], respectively).

In terms of variables related to body perception, there was a significant difference between native and non-native English speakers in “appreciating body awareness” (ABA) ($F(1,130) = 12.551$, $p < 0.01$), “self-regulation” ($F(1,130) = 4.231$, $p < 0.05$) and “body listening” ($F(1,130) = 11.270$, $p < 0.01$). Interestingly, BMI did not have any correlation with all interoceptive scales and subscales of BMQ and MAIA (see Table 3).

Independent Relations Between Components of Interoceptive Sensitivity, Confounds and Alexithymia

Pearson r correlational analysis was used to examine the correlation between variables. Confounding factors including depression, anxiety and somatisation had significant positive correlations with DDF and DIF. DIF subscale of TAS-20 was negatively associated with the EBA subscale of BMQ, “self-regulation”, “body listening” and “trusting” of MAIA. In addition, inverse correlations were also observed between DIF and these interoceptive variables, which include EBA, “self-regulation” and “trusting”. In general, although the above mentioned interoceptive variables were significantly associated with alexithymia scores, the effects were small.

Table 3

Independent Correlations Between DDF/ DIF and Related Variables

	TAS - DDF			TAS - DIF		
	r	95% CI		r	95% CI	
		LL	UL		LL	UL
Age	-.249	-.415	-.085	-.130	-.319	.060
BMI	.055	-.107	.208	.037	-.142	.203
BMQ - EBA	-.301	-.456	-.126	-.347	-.513	- .163
BMQ - ABA	-.137	-.339	.063	-.054	-.250	.127
MAIA - Attention Regulation	-.137	-.310	.061	-.119	-.326	.081
MAIA - Emotional Awareness	-.154	-.330	.012	.000	-.217	.200
MAIA - Self- Regulation	-.273	-.448	-.092	-.256	-.440	- .077
MAIA - Body Listening	-.185	-.346	-.013	-.040	-.223	.133
MAIA - Trusting	-.344	-.491	-.184	-.312	-.489	- .129
Depression	.442	.290	.593	.553	.410	.672
Anxiety	.387	.260	.518	.540	.420	.659
Somatisation	.253	.080	.406	.427	.253	.579

Note. CI = confidence interval; TAS = Toronto Alexithymia Scale; DDF = Difficulty Describing Feelings; DIF = Difficulty Identifying Feelings; BMI = Body Mass Index; BMQ = Body Mindfulness Questionnaire; EBA = Experiencing Body Awareness; ABA = Appreciating Body Awareness; MAIA - Multidimensional Assessment of Interoceptive Awareness; Bold = significant correlation

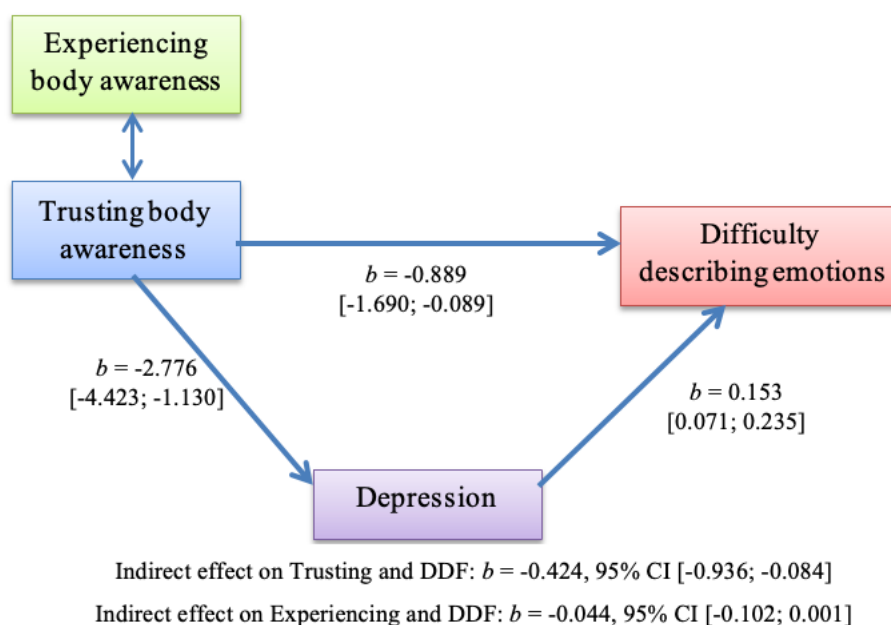
Relative Associations Between Components of Interoceptive Sensitivity and Alexithymia

As alexithymia was significantly correlated with various interoceptive and confounding variables, it is of importance to assess their unique predictive utility by using linear regression for multiple variables. In separate hierarchical models, DDF and DIF were dependent variables while interoceptive factors were entered in the first block of independent variables and significant confounds including depression, anxiety and somatisation were inputted in the second block.

With DDF, the results revealed that both steps of the model could significantly predict the outcomes. The first step was significant with $F(3, 126) = 8.932, p < 0.001$ and accounted for 17.5% of the variance in DDF. The second was also significant with $F(6, 123) = 7.394, p < 0.001, \Delta R^2 = 0.090$. At the first step, EBA and “trusting” predicted alexithymia with $B = -0.157$ and -1.079 , 95% CIs $[-0.286, -0.033]$ and $[-2.038, -0.249]$, respectively. However, when depression, anxiety and somatisation were added at step two, neither of these predictors were longer significant. The only factor that predicted DDF was depression ($B = 0.110$, 95% CI $[0.004, 0.256]$). This suggested that the effects of EBA and “trusting” on DDF scores were reduced under the influence of depression.

Figure 1

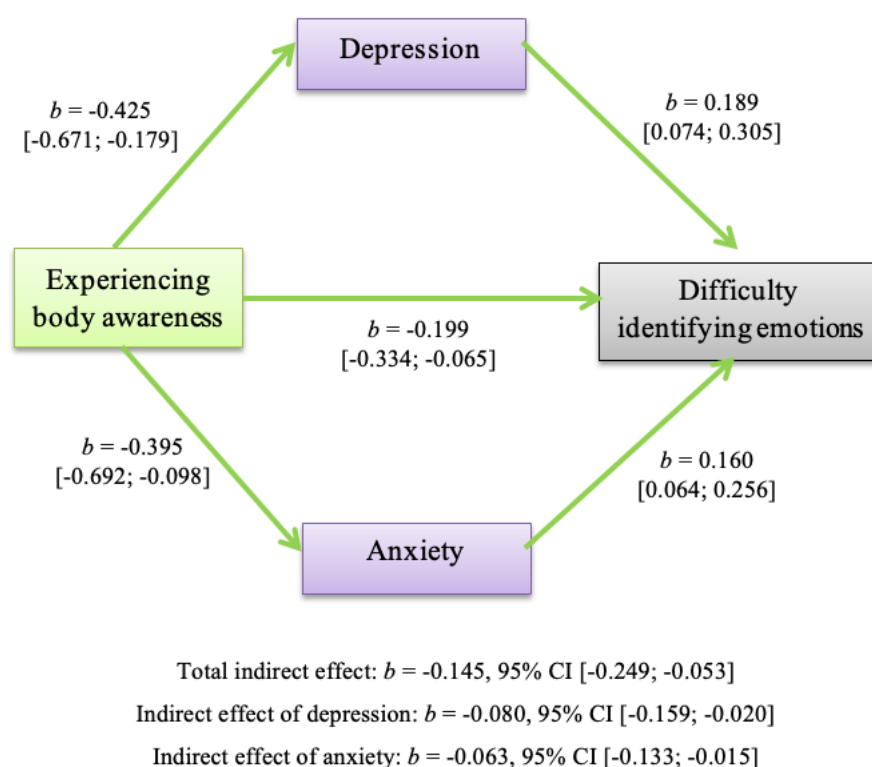
Mediation Model of Experiencing, Trusting Body Awareness, Depression and Difficulty Describing Emotions



Regression models in which DIF was the dependent variable also shared lots of similarities. Both steps of the model were able to predict the difficulty in identifying emotions with $F(3, 126) = 9.399, p < 0.001, R^2 = 0.183$ for step one and $F(6, 123) = 13.989, p < 0.001, \Delta R^2 = 0.223$ for step two. At the first step, EBA was the only negative predictor of alexithymia ($B = -0.266$, 95% CI $[-0.439, -0.084]$). Neither “self-regulation” nor “trusting” were significant. When confounding factors including depression, anxiety and somatisation were controlled in the second step, EBA still predicted alexithymia ($B = -0.180$, 95% CI $[-0.335, -0.028]$). Noticeably, both depression ($B = 0.165$, 95% CI $[0.043, 0.287]$) and anxiety ($B = 0.138$, 95% CI $[0.031, 0.252]$) were positive predictors of DIF.

Figure 2

Mediation Model of Experiencing Body Awareness, Depression, Anxiety and Difficulty Identifying Emotions



Discussion

The present study aimed to examine the link between alexithymia and IS and the effect of covariates on this relationship. Our findings confirmed that DDF and DIF were negatively correlated with different aspects of IS such as “experiencing body awareness”, “self-regulation”, “body listening” and “trusting”. When mindfulness was considered to measure the observance, accompanying and appreciation aspect of body perception (“experiencing body awareness” (EBA) together with “trusting body awareness”) was evident to be the most powerful factors in regression models of alexithymia, despite the effects of depression and anxiety.

Various IS aspects were evident to be inversely correlated with alexithymia in the present study. To be specific, alexithymia gets higher when individuals are not able to observe and accompany with their bodies, regulate their distress by body attention, listen to and feel their body as safe and trustworthy. This result was supported by previous findings (Herbert et al., 2011; Shah et al., 2016; Zamariola et al., 2018). Therefore, our finding also supported the argument considering alexithymia as a general deficit of interoception (Murphy, Catmur, et al., 2017; Brewer et al., 2016). However, it is also worth underlying that significant relationships were observed mostly in more developed factors of IS, comprising “self-regulation”, “body listening” and “trusting”. Those high-level interoceptive abilities require beneficial and mindful ways to focus on and self-regulate bodily symptoms (W. E. Mehling et al., 2012). In contrast, no significant relationship was found between alexithymia and more anxious and hypervigilance-driven styles of attention such as “distracting” and “worrying” (Zamariola et

al., 2018). Therefore, it could be suggested that only adaptive attention style of IS negatively linked with alexithymia.

Equally important, for the first time body mindfulness was examined and proved to strongly correlate with and predict alexithymia. In other words, the ability to observe and “be with” the body in general status without being distracted was less prevalent in those who suffered difficulties in describing and identifying their emotions. This finding was in line with previous studies about the links between general mindfulness and alexithymia (Cooper et al., 2018; Farb et al., 2013). Empirical findings were also in line with our result, reporting changes in interoceptive abilities through the “body scan” (Fische et al., 2017) and the “opening the door of the body” strategy in the Mindfulness-based Cognitive Training programme (Segal et al., 2002). Thus, the enhancement of body perception through mindfulness practice could serve to improve emotional problems in alexithymia.

Beyond the role of observing and accompanying body perception, the listening and trusting attitude towards body changes also has an intimate association with alexithymia. This result supported the role of interpretation and appreciation in defining how one reacts to physiological changes (Burg et al., 2017). This is in line with the study by Muehlenkamp et al. (2013), which reported the moderating effect of body regard on the relationship between emotional dysregulation and non-suicidal self-injury behaviors. On the contrary, high awareness without trusting can evoke anxiety and hypervigilance, thus leading to the excessive concern of body symptoms like in those with somatisation or hypochondriasis (W. Mehling, 2016). Thus active listening and seeing our body as trustworthy may help individuals to interpret, accept and respond positively towards bodily signals.

More interestingly, the association between IS and alexithymia could be explained by moods as confounding factors. Previously, several studies have reported the correlation between body awareness and mood (Hamilton, 2008; Li et al., 2015) and body appreciation and mood (Muehlenkamp et al., 2013; Winter et al., 2017). Besides, alexithymia, especially DDF and DIF subscales, was proved to be closely related to depression (Honkalampi et al., 2000; Marchesi et al., 2000; Parker et al., 1991) and anxiety (Karukivi et al., 2010; Marchesi et al., 2000). Depression was also found as a covariate between alexithymia and IAcc (Herbert et al., 2011; Shah et al., 2016). Our result was in line with this contention, suggesting that the impairment of various functions of IS and the development of alexithymia could be allocated to mood problems. It was also supported that moods could impact not only objective interoception but also IS.

That said the pathways connecting IS, moods and alexithymia request further exploration. Mood problems may lead to poor performance in emotion identification tasks due to negative thinking and schemas (Hintikka et al., 2004; Lackner & Fresco, 2016), attentional biases (Suciu et al., 2017), emotion-specific impairments and oversensitivity in negative expression (Berga et al., 2016) and low confidence in identifying emotions (Fieker et al., 2016). Thus, altered cognitive functions could play a key role in affecting this association. Besides, the role of self-criticism and judging of body image and negative self-reference should be considered. People who were more critical and judging about their body image got higher levels of depression (Davis & Katzman, 1997; Hamilton, 2008). Crucially, when high levels of negative self-reference (i.e., brooding rumination) coupled with low levels of interoceptive awareness, depression and anxiety-related distress reached their peaks and vice versa (Lackner & Fresco, 2016). Interoception ability could also ameliorate the effect of rumination on affect by deliberately switching the concern towards bodily signals (Lackner & Fresco, 2016; Teasdale,

1999). Therefore, the lack of various cognitive structures for interoceptive and emotional signals as well as negative appraisal of body image could explain the link between interoception, mood and alexithymia. Further research should investigate more on these processes as mechanisms underlying the association.

Several limitations to this study and further suggestions should be considered. Firstly, our information was gathered from a sample of young and well-educated healthy adults, which could limit the generalizability of our conclusions. Secondly, the present study focused on the IS only, which were not fully reflect all three aspects of interoception. Especially, when being examined together in the same sample, their effects on alexithymia could be modulated by each other (Zamariola et al., 2018). Finally, despite our effort to propose the predictive models, as with all cross-sectional studies, causality cannot be established. More longitudinal studies among healthy and clinical samples are being required to establish the temporal order of these relationships.

Conclusion

The present results indicated the close relationship between different aspects of interoceptive sensibility and alexithymia as well as the mediating effect of mood. Difficulties in describing and identifying emotions were inversely correlated with various subscales of MAIA and BMQ, suggesting that alexithymia could be a general deficit of interoception. Among these factors, those with the adaptive attention style showed stronger links with alexithymia, thus the emotional clarity improves when individuals develop beneficial and mindful interoceptive attention. Especially, for the first time body mindfulness, particularly awareness and accompaniment aspect, was proved to strongly predict alexithymia and to be one of the most fundamental components of interoceptive sensibility. Trusting our body awareness was also a significant factor, which illustrated the interaction of awareness and trusting while perceiving body signals. Interestingly, our finding of inverse correlation between subjective interoception and alexithymia raised a question about the correlational direction that varied in previous studies. Differences in types of alexithymia, classified by various deficits in cognition and affect, could influence the direction. Finally, depression and anxiety contributed to explain the association as significant mediators. This finding provides the new pathway to understand the interaction of body perception, mood and problems with emotional clarity. It also supports the state-dependent aspect of the secondary alexithymia and requires more exploration of underlying mechanisms. Previous studies suggested several explanations for this mediating effect such as cognitive impairments related to mood disorders and the role of negative self-criticism and self-reference.

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