A meta-analysis on the relationship between interoceptive awareness and alexithymia: Distinguishing interoceptive accuracy and sensibility

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BACKGROUND

- Alexithymia is a multi-faceted construct consisting of:
  a) difficulties identifying and describing one's emotions,
  b) difficulty distinguishing emotional feelings from bodily sensations,
  c) an "externally-oriented thinking style" focused on external realities with limited self-reflective thought towards inner experience, and
  d) limited imagination and fantasy life (Nemiah et al., 1976).
- Alexithymia is not a condition listed in the DSM-5 but has high co-occurrence with ASD and other psychopathologies (Murphy et al., 2017).
- Alexithymia may emerge from deficits in "interoceptive awareness," or the process by which the nervous system senses, interprets, and integrates signals originating in one's own body (Khalsa et al., 2018).
- Findings regarding the link between interoceptive awareness and alexithymia have been inconsistent.
- This meta-analysis used an adapted framework (Khalsa et al., 2018) to determine which aspects of interoceptive awareness are associated with alexithymia, and to determine methodological and participant factors that contribute to variability in findings.

METHOD

- A meta-analysis using Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) guidelines was conducted (Moher et al., 2009).
- A total of 66 independent samples from 44 separate published articles or unpublished dissertations met our inclusion criteria, yielding 80 effect sizes.
- The total combined sample size of this meta-analysis was N = 7146.
- We grouped effect sizes into several different components as defined by Khalsa et al. 2018).

Components of Interoceptive Awareness

- **Objective Interoceptive Accuracy: I**ncludes heartbeat tracking methods or other tasks that compare a participant's perception of internal signals to their actual internal signals.
- **Subjective Interoceptive Accuracy:** Self-reported ability to accurately perceive and distinguish interoceptive signals (e.g., "I can always accurately perceive when I am hungry").
- **Sensibility:** Self-perceived dispositional tendency to focus on interoceptive stimuli across daily life (e.g., " I notice when I am uncomfortable in my body").
- **Magnitude:** Self-reported *intensity* of sensation in response to an experimentally induced stimulus.
- **Detection:** A binary variable that is measured as a participant's perception of a stimulus as being present or absent.
- **Insight:** A metacognitive measure operationalized as the correspondence between subjective and objective measures—for example, the correspondence between accuracy and performance confidence on specific tasks or the correspondence between objective and self-report arousal in response to emotionally arousing stimuli.

RESULTS

Summary Effects

- The overall summary effect size between interoceptive awareness and alexithymia across all independent samples was r = -.162, p = .001, CI[-.252, -.068].
- There was statistically significant effect size heterogeneity, $Q(65)$ = 972.728, p < .001.
- 93.3% of between-studies variance can be explained by study-level covariates (I^2 = 93.318).
- These statistics indicate substantial variability among effect sizes, justifying further exploration of the study-level covariates that contribute to this variability (see Tables 1 and 2, and additional moderator Analyses).

Table 1. Effect Sizes by Outcome Variable

	k	Sample size	Pearson's *r*	*p*-value	95% CI	
					Lower	Upper
Subjective IAcc	23	2314	-.437	<.001	-.551	-.307
Objective IAcc	32	2565	-.049	.288	-.138	.041
Sensibility	16	2741	.077	.211	-.044	.195
Magnitude	6	439	.095	.227	-.059	.246
Detection	2	99	-.085	.705	-.482	.341
Insight	1	26	-.570	.002	-.784	-.234

Note. Subjective IAcc = Subjective Interoceptive Accuracy; Objective IAcc = Objective Interoceptive Accuracy; k = number of effects; CI = Confidence Interval.

Moderating Effect of Participant Diagnosis

- For this analysis, effect sizes from the same samples were collapsed to maintain statistical independence which allowed us to test whether effect sizes from different diagnosis groups were statistically different from each other.
- The between-levels difference using a Mixed Effects model was statistically significant, $Q_B(3)$ = 23.057, p < .001.

Table 2. Moderating Effect of Participant Diagnosis

	k	Sample size	Pearson's *r*	*p*-value	95% CI	
					Lower	Upper
ASD	6	693	-.507	<.001	-.738	-.169
Eating Disorders	8	710	-.049	.288	-.676	-.320
Other Clinical	5	455	.077	.211	-.484	.093
TD	47	5288	-.042	.294	-.120	.036

Note. "Other Clinical" includes samples of functional motor disorders, depersonalization/derealization disorders, drug and alcohol addicts, fibromyalgia syndrome, and one sample containing a variety of psychiatric disorders; k = number of effects; CI = Confidence Interval.

Moderating Effect of Sensibility Measure

- No significant relationship between alexithymia and sensibility overall, $r(15)$ = .077, p = .211, CI[-.044, .195].
- However, this relationship was moderated by the questionnaire that was used to measure sensibility, $Q(4)$ = 35.783, p < .001.
- There was a significant positive relationship between alexithymia and the Porges Body Questionnaire (Porges, 1993), $r(5)$ = .262, p < .001, CI[.126, .389].
- There was a significant negative relationship between alexithymia and relevant subscales of the Multidimensional Assessment of Interoceptive Awareness (Mehling et al., 2012), $r(3)$ = -.213, p = .011, CI[-.366, -.050].

CONCLUSION

Alexithymia is moderately associated with *subjective* interoceptive accuracy but not *objective* interoceptive accuracy.

- Significant associations with subjective interoceptive accuracy could be due to shared method variance.
- Null associations between objective interoceptive accuracy could be due to confounders (e.g., heart rate variability, BMI, etc.) (Murphy et al., 2018).

Interoceptive awareness is associated with alexithymia in the ASD and eating disordered populations but not the general population.

- Suggests a specific neurophysiological vulnerability for alexithymia in ASD and other clinical populations.

The two most prominent measures of sensibility (MAIA and BPQ) have opposite relationships with alexithymia.

- These questionnaires may be measuring different constructs.

Future Research

- In the same way sensory sensitivities in ASD represent both "hyper" or "hypo" perception of sensory input, Interoceptive awareness may also be differentiated by hyper or hypo focus on interoceptive cues. Future Research may benefit from development of objective or self-report measures that distinguish between hyper and hypo-sensitivities to interoceptive cues.
- Discrepancies between objective and self-reported arousal (i.e., "insight") in response to emotion-eliciting stimuli is one of the most promising methods for assessing the interoceptive awareness of emotional arousal (Gaigg, 2018) and future research is needed validate such methods and develop similar methods that use other measures of objective arousal such as electroencephalography and electromyography.

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