

A MULTICENTRIC OBSERVATIONAL AND EXPLORATORY STUDY ON REFLECTIVE FUNCTIONING AND INTEROCEPTIVE AWARENESS IN INDIVIDUALS WITH EATING DISORDERS

Veronica Raspa¹, Margherita Guercini^{2,3}, Iaria Lupattelli^{2,3}, Patrizia Moretti^{2,3}, Claudia Mazzeschi⁴, Laura Dalla Ragione⁵ & Alfonso Tortorella^{1,2,3}

¹Division of Psychiatry, Clinical Psychology, and Psychiatric Rehabilitation of the General Hospital of Perugia, Perugia, Italy

²School Specialization of Psychiatry, Department of Medicine and Surgery, University of Perugia, Perugia, Italy

³Section of Psychiatry, Department of Medicine and Surgery, University of Perugia, Perugia, Italy

⁴Department of Philosophy, Social, Human, and Educational Sciences, University of Perugia

⁵Food Science and Human Nutrition Unit, University Campus Biomedico of Rome, University of Rome, Rome, Italy

SUMMARY

Background: Reflective functioning and interoceptive awareness are core domains in the psychological functioning of individuals with eating disorders (EDs). Alterations in these dimensions may contribute to emotional dysregulation and body image disturbances, which are hallmark features of EDs. To compare reflective functioning and interoceptive awareness between individuals with EDs and a non-clinical control group, and to explore associations with general psychological functioning and eating disorder symptomatology within the clinical sample.

Methods: A total of 65 participants were recruited (32 clinical, 33 control group). Participants completed the EDI-3, the CORE-OM, the RFQ, and the MAIA. The Mann-Whitney U test and Spearman correlations were conducted to assess between-group differences and associations among psychological variables.

Results: The clinical group showed more severe symptomatology, greater psychological difficulties, increased uncertainty in the attribution of mental states and reduced interoceptive awareness. Significant correlations emerged between ED symptom severity and both interoceptive and reflective capacities.

Conclusions: The findings highlight the relevance of reflective functioning and interoceptive awareness as transdiagnostic dimensions in EDs. These results support the integration of therapeutic approaches targeting these mechanisms in the treatment of eating disorders.

Key words: eating disorders - interoceptive awareness – reflective functioning - symptoms

Abbreviations: ED - Eating Disorders; AN - Anorexia Nervosa; BN - Bulimia Nervosa; BED - Binge Eating Disorder; EDI-3 - Eating Disorder Inventory-3; RFQ - Reflective Functioning Questionnaire; MAIA - Multidimensional Assessment of Interoceptive Awareness; CORE-OM - Clinical Outcomes in Routine Evaluation–Outcome Measure; OSFED - Other Specified Feeding and Eating Disorders

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INTRODUCTION

Eating disorders (EDs) are complex syndromes that go far beyond dysfunctional eating behaviors, involving profound alterations in emotional regulation, bodily experience, and relational functioning (Treasure et al. 2015). In recent years, the scientific literature has highlighted two key transdiagnostic processes in the understanding of EDs: mentalization, operationalized as reflective functioning, and interoceptive awareness.

Reflective functioning refers to the ability to understand and attribute mental states to oneself and others, emotions, intentions, beliefs, and is considered a central component of emotional regulation (Fonagy & Luyten 2009). Individuals with EDs often exhibit impairments in this capacity: emotions are not symbolically processed or narratively integrated but are instead acted out through the body, as in food restriction, bingeing, or purging behaviors (Gagliardini et al. 2020, Monteleone et al. 2020). Similarly, interoceptive

awareness, the ability to perceive, interpret, and regulate internal bodily sensations, is frequently compromised in EDs, especially anorexia nervosa (Khalsa et al. 2018, Pollatos et al. 2008). This impairment can contribute to difficulties in emotional regulation, body image construction, and dissociative phenomena (Martin et al. 2019, Phillipou et al. 2022). A growing body of research highlights the need to go beyond symptom-focused models and consider EDs as disorders of embodiment, affecting how individuals experience and relate to their own bodies. For instance, a two-year follow-up study by Rossi et al. (2021) proposed an integrated model combining enhanced cognitive behavioural therapy with a phenomenological approach, emphasizing the centrality of bodily experience in treatment. Despite the growing recognition of both domains, their interconnection has been underexplored. The embodied mentalization model posits that mentalizing develops through early interoceptive and bodily experiences within primary attachment relationships (Fotopoulou & Tsakiris 2017). In

EDs, the body is often experienced as threatening or alien, potentially impairing reflective functioning (Badoud & Fonagy 2015, Trevisan et al. 2019). This study aims to compare individuals with EDs and healthy controls on psychological symptoms, reflective functioning, and interoceptive awareness. It is hypothesized that the clinical group will show greater psychopathology and lower levels of mentalization and interoception, with these deficits associated with increased symptom severity (Badoud & Fonagy 2015, Khalsa et al. 2018, Monteleone et al. 2019).

SUBJECTS AND METHODS

The total sample consisted of 65 participants (50 females and 15 males), with a mean age of 30.73 years ($SD = 11.19$). The study was conducted at the DNA outpatient clinic of Perugia Hospital and at specialized centers within the Umbria regional network for DNA (USL Umbria 1). Clinical participants were recruited during routine care, provided informed consent, and completed the assessment anonymously. The control group included medical students and trainees from the University of Perugia, who also consented and completed the same measures. The study received ethical approval and followed the Declaration of Helsinki. Inclusion criteria for the clinical group were: diagnosis of an ED, age 18–65, Italian language proficiency, and informed consent. Exclusion criteria included severe psychiatric or neurological disorders, intellectual disability, or medical conditions affecting assessment.

Measures

The EDI-3 (Garner 2004) is a self-report questionnaire composed of 91 items designed to assess psychological traits and symptomatology related to eating disorders. It includes six composite scores reflecting specific domains: Eating Disorder Risk Composite (EDRC): Combines three symptom scales, Drive for Thinness (DT), Bulimia (B), and Body Dissatisfaction (BD). Ineffectiveness Composite (IC): Reflects feelings of inadequacy and low self-worth, including Low Self-Esteem (LSE) and Personal Alienation (PA). Interpersonal Problems Composite (IPC): Captures difficulties in forming secure and trusting relationships, combining Interpersonal Insecurity (II) and Interpersonal Alienation (IA). Affective Problems Composite (APC): Reflects emotional dysregulation and difficulty identifying internal states, comprising Interoceptive Deficits (ID) and Emotional Dysregulation (ED). Overcontrol Composite (OC): Associated with excessive self-discipline and avoidance of adult responsibilities, including Perfectionism (P) and Maturity Fears (MF). General Psychological Maladjustment Composite (GPMC): Represents an overall index of psychological dysfunction, encompassing all trait

scales (LSE, PA, II, IA, ID, ED, P, MF). The EDI-3 has demonstrated good psychometric properties (Clausen et al. 2011). The CORE-OM (Evans et al. 2002) is a 34-item self-report instrument designed to assess the severity of psychological distress over the previous seven days. It includes four subscales: Well-being (WB), Symptoms (S): Including anxiety, depression, somatic complaints, and trauma-related symptoms. Functioning (F): Measuring general and social functioning. Risk (R): Assessing the risk of self-harm or harm to others. Higher scores indicate greater psychological distress. Clinical cut-off scores for severity are as follows: <11 = non-clinical, $10.1–15$ = mild, $15.1–20$ = moderate, $20.1–25$ = moderate-severe, and $25.1–40$ = severe. Italian normative data are available (Palmieri et al. 2009). The RFQ (Fonagy et al. 2016) is an 8-item self-report scale assessing the individual's capacity to mentalize. It includes two subscales: Certainty about mental states (RFQ_C): Measures confidence in understanding one's own and others' mental states. Moderate scores indicate flexible and adaptive reflective functioning. Uncertainty about mental states (RFQ_U): Reflects confusion or difficulty in understanding mental states. Lower scores are indicative of better reflective functioning. The RFQ-8 has been validated in populations with eating disorders and borderline personality disorder (Fonagy et al. 2016). The MAIA (Mehling et al. 2012) is a 32-item self-report instrument that measures interoceptive awareness across eight dimensions: Noticing (NOT), Not-Distracting (ND), Not-Worrying (NW), Attention Regulation (AR), Emotional Awareness (EA), Self-Regulation (SR), Body Listening (BL), and Trusting (TR). Each subscale score is calculated as the mean of its corresponding items, with higher scores indicating greater interoceptive awareness. The Italian version has shown good reliability and validity in both clinical and non-clinical samples (Cali et al. 2015).

Statistical Analysis

Analyses were performed with SPSS 22 using raw scores. Most variables violated normality (Shapiro-Wilk), except three MAIA subscales. Nonparametric Mann-Whitney U tests compared groups, and Spearman's correlations examined associations. P-values were adjusted for multiple comparisons using FDR (Benjamini & Hochberg 1995). Effect sizes were calculated via rank-biserial correlations. Significance was set at adjusted $p < 0.05$.

RESULTS

The total was predominantly unmarried (84.6%) and employed (52.3%), with a university degree reported by 50.8%. The clinical group ($N = 32$; mean age = 28.16, $SD = 12.11$) included 84.4% cisgender women

Table 1. Sociodemographic characteristics of clinical and control groups

	Total Sample (n = 65)	Clinical Group (n = 32)	Control Group (n = 33)
Mean Age (SD)	30.73 (11.19)	28.16 (12.11)	33.48 (9.57)
Marital Status	(55) 84.6% not married (8) 12.3% married (2) 3.1% divorced	(29) 90.6% not married (1) 3.1% married (2) 6.3% divorced	(26) 78.8% not married 7 (21.2%) married
Employment Status	(34) 52.3% employed (26) 40% students (1) 1.5% homemakers	(6) 18.8% employed (21) 65.6% students (1) 3.1% homemakers	(28) 84.8% employed (5) 15.2% students
Education Level	(20) 30.8% high school (24) 50.8% university, (18) 13.8% postgraduate	(20) 62.5% high school (9) 28.1% postgraduate	(24) 72.7% university, (9) 27.3% postgraduate
Relationship Status	(29) 44.6% with partner	(7) 21.9% with partner (25) 78.1% without partner	(22) 66.7% with partner (11) 33.3% without partner
Gender Identity	(50) 76.9% cisgender women (15) 23.1% cisgender men	(27) 84.4% cisgender women (5) 15.6% cisgender men	(23) 69.7% cisgender women (10) 30.3% cisgender men

Table 2. Group comparisons on psychological measures

	Full sample (N = 65)		Clinical group (N = 32)		Control group (N = 33)	
	M	SD	M	SD	M	SD
EDI 3_EDRC	37.15	30.79	62.62	22.86	14.96	16.01
EDI 3_IC	17.40	15.44	29.79	13.18	6.18	5.56
EDI 3_IPC	17.22	12.23	26.82	10.42	9.09	6.33
EDI 3_APC	16.73	18.1	31.96	16.27	3.81	4.14
EDI 3_OC	14.85	11.78	24.28	9.91	6.84	5.78
EDI 3_GPMC	77.48	60.44	132.57	45.57	32.71	20.72
CORE – OM_F	14.56	9.52	21.31	8.51	8.63	5.67
CORE – OM_WB	6.66	4.91	10.46	4.09	3.21	2.42
CORE – OM_S	18.25	13.38	28.03	11.24	8.46	6.35
CORE – OM_R	1.64	3.20	3.25	4.03	0.12	0.33
RFQ_C	1.10	0.63	0.76	0.49	1.42	0.58
RFQ_U	0.84	0.48	1.09	0.54	0.61	0.26
MAIA_NOT	2.93	1.31	3.32	0.97	2.62	1.47
MAIA_ND	3.57	1.10	3.78	1.16	3.40	1.04
MAIA_NW	3.46	1.29	2.93	1.51	3.89	0.88
MAIA_AR	2.94	1.26	2.32	1.32	3.44	0.96
MAIA_EA	3.08	1.23	3.26	1.28	2.94	1.18
MAIA_SR	2.19	1.33	1.49	1.24	2.76	1.12
MAIA_BL	2.28	1.47	1.21	1.29	3.15	0.94
MAIA_TR	2.51	1.69	1.08	1.13	3.67	1.05

and 15.6% cisgender men. Diagnoses were Anorexia Nervosa (50%), Bulimia Nervosa (21.9%), Binge Eating Disorder (3.1%), and OSFED (25%). Most were single (90.6%) and students (65.6%), with 62.5% holding a high school diploma and 28.1% postgraduate education. The control group (N = 33; mean age = 33.48, SD = 9.57) comprised 69.7% cisgender women and 30.3% cisgender men, with 78.8% unmarried and 84.8% employed. Educational levels included 72.7% university degrees and 27.3% postgraduate education (Tables 1 - 2).

Mann-Whitney U tests showed the clinical group scored significantly higher on all EDI-3 and CORE-

OM subscales, and on RFQ Certainty ($r = 0.53$) and Uncertainty ($r = 0.47$), indicating more severe eating disorder symptoms and lower reflective functioning (all FDR-corrected $p < 0.001$). The Eating Disorder Risk Composite (EDRC) mean was 62.62 (SD = 27.22) in the clinical group versus 14.96 (SD = 8.77) in controls. Psychological distress (CORE-OM Symptoms) averaged 19.38 (SD = 7.69) vs. 6.97 (SD = 5.30), reflective functioning (RFQ_C) 5.16 (SD = 1.47) vs. 6.64 (SD = 0.91), and interoceptive awareness (MAIA Attention Regulation) 1.88 (SD = 0.94) vs. 3.03 (SD = 0.80). Significant lower scores were also found in Not-Worrying ($r = 0.37$, $p = 0.012$), Attention Regulation

($r = 0.43$, $p = 0.003$), Self-Regulation ($r = 0.48$, $p < 0.001$), Body Listening ($r = 0.68$, $p < 0.001$), and Trusting ($r = 0.80$, $p < 0.001$). No differences emerged for Noticing, Not Distracting, or Emotional Awareness (all $p > 0.15$). Effect sizes ranged from moderate to large (Table 3). Within the clinical group, symptom severity positively correlated with RFQ Uncertainty and negatively with interoceptive awareness subscales: Attention Regulation ($\rho = -0.65$), Self-Regulation ($\rho = -0.69$), Body Listening ($\rho = -0.67$), and Trusting ($\rho = -0.72$), all $p < 0.001$. Reflective functioning (RFQ_U) correlated negatively with multiple MAIA subscales, indicating that lower interoceptive awareness is associated with greater mentalization difficulties. All correlations survived FDR correction (Table 4).

DISCUSSION

Consistent with previous literature, individuals in the clinical group exhibited significantly higher scores on the EDI-3, indicating greater severity of eating disorder symptoms, and higher psychological distress on the CORE-OM. These findings support well-established associations between FEDs and comorbid. Moreover, participants with FEDs displayed lower scores in reflective functioning and interoceptive awareness, aligning with theoretical accounts of embodied mentalization. The observed negative correlations

between interoceptive awareness and symptomatology as well as between interoceptive awareness and uncertainty about mental states, underscore the role of body-based awareness in emotional processing and self-regulation. These findings provide preliminary, exploratory support for the idea that deficits in interoceptive awareness and reflective functioning may be intertwined features of the clinical phenotype of eating disorders, offering directions for future research (Badoud & Fonagy 2015, Mehling et al. 2012, Trevisan et al. 2019). Clinically, these results suggest that interventions targeting bodily awareness and mentalizing capacities, such as Mentalization-Based Therapy, could be beneficial in treating FEDs.

CONCLUSION

This study highlights the relevance of integrating reflective functioning and interoceptive awareness into the assessment and treatment of Feeding and Eating Disorders. These dimensions appear to be deeply interconnected with symptom severity and emotional suffering, reinforcing the importance of body-based and mentalizing approaches in clinical settings. Further research is encouraged to expand these findings and explore their application in broader, more diverse populations.

Table 3. Comparison between clinical and control groups of psychological dimensions

	Mean rank Clinical group	Mean rank Control group	U	z	P (FDR corrected)	R
EDI 3_EDRC	43.17	17.60	49.5	-5.75	<0.001	0.72
EDI 3_IC	45.16	18.17	53.5	-5.93	<0.001	0.74
EDI 3_IPC	45.39	18.79	59.0	-5.83	<0.001	0.73
EDI 3_APC	46.55	17.80	26.5	-6.31	<0.001	0.79
EDI 3_OC	45.43	18.76	58.0	-5.85	<0.001	0.73
EDI 3_GPMC	44.54	17.28	25.0	-6.11	<0.001	0.77
CORE – OM_F	44.53	20.05	100.5	-5.34	<0.001	0.66
CORE – OM_WB	46.08	19.20	72.5	-5.83	<0.001	0.73
CORE – OM_S	46.34	18.66	69.0	-5.95	<0.001	0.74
CORE – OM_R	41.71	23.85	226.0	-4.47	<0.001	0.56
RFQ_C	42.76	21.03	199.0	-4.21	<0.001	0.53
RFQ_U	43.92	19.94	234.5	-3.76	<0.001	0.47
MAIA_NOT	33.58	26.19	310.0	-1.66	0.152	0.21
MAIA_ND	32.62	26.97	335.0	-1.27	0.202	0.16
MAIA_NW	23.06	34.73	248.5	-2.63	0.012	0.37
MAIA_AR	21.98	35.61	220.5	-3.06	0.003	0.43
MAIA_EA	32.08	27.41	349.0	-1.05	0.294	0.15
MAIA_SR	21.15	36.28	199.0	-3.40	<0.001	0.48
MAIA_BL	17.75	39.05	110.5	-4.83	<0.001	0.68
MAIA_TR	15.60	40.80	54.5	-5.68	<0.001	0.80

Note: U = Mann-Whitney U statistic; Z = standardized test statistic; r = effect size calculated; p-values corrected using the False Discovery Rate (FDR) procedure by Benjamini-Hochberg; Significant p-values are those < 0.05 after FDR correction

Table 4. Correlations between EDI-3, RFQ, and MAIA measures in the clinical sample

	1	2	3	4	5	6	7	8
EDI 3_EDRC		0.335	0.467*	0.579**	0.504**	-0.047	0.496*	0.224
CORE OM_F	0.335		0.724**	0.711**	0.596**	-0.144	0.458*	-0.211
CORE OM_WB	0.467*	0.724**		0.901**	0.672**	-0.357	0.733**	0.189
CORE OM_S	0.579**	0.711**	0.901**		0.759**	-0.192	0.741**	0.224
CORE OM_R	0.504**	0.596**	0.672**	0.759**		-0.215	0.626**	0.336
RFQ_C	-0.047	-0.144	-0.357	-0.192	-0.215		-0.281	-0.014
RFQ_U	0.496*	0.458*	0.733**	0.741**	0.626**	-0.281		0.430*
MAIA_NOT	0.224	-0.211	0.189	0.224	0.336	-0.014	0.430*	
MAIA_ND	0.228	-0.012	0.208	0.251	0.396	-0.243	0.231	0.164
MAIA_NW	-0.181	-0.054	-0.256	-0.390*	-0.415*	0.316	-0.502**	-0.289
MAIA_AR	-0.488*	-0.690**	-0.552**	-0.606**	-0.595**	0.383	-0.522**	-0.007
MAIA_EA	-0.220	-0.757**	-0.460*	-0.428*	-0.369	0.137	-0.278	0.368
MAIA_SR	-0.558**	-0.496*	-0.526**	-0.616**	-0.660**	0.197	-0.480*	0.014
MAIA_BL	-0.452*	-0.517*	-0.433*	-0.602**	-0.536**	0.043	-0.480*	0.014
MAIA_TR	-0.361	-0.329	-0.200	-0.306	-0.477*	0.015	-0.409*	-0.257
		9	10	11	12	13	14	15
EDI 3_EDRC		0.228	-0.181	-0.488*	-0.220	-0.558**	-0.452*	-0.361
CORE OM_F		-0.012	-0.054	-0.690**	-0.757**	-0.496*	-0.517*	-0.329
CORE OM_WB		0.208	-0.256	-0.552**	-0.460*	-0.526**	-0.433*	-0.200
CORE OM_S		0.251	-0.390*	-0.606**	-0.428*	-0.616**	-0.602**	-0.306
CORE OM_R		0.396	-0.415*	-0.595**	-0.369	-0.660**	-0.536**	-0.477
RFQ_C		-0.243	0.316	0.383	0.137	0.197	0.043	0.015
RFQ_U		0.231	-0.502**	-0.522**	-0.278	-0.480*	-0.480*	-0.409*
MAIA_NOT		0.164	-0.289	-0.007	0.368	0.029	0.014	-0.257
MAIA_ND			-0.545**	-0.291	0.006	-0.295	-0.066	-0.493*
MAIA_NW		-0.545**		0.392*	-0.057	0.232	0.267	0.483*
MAIA_AR		-0.291	0.329*		0.636*	0.678**	0.652**	0.479*
MAIA_EA		0.006	-0.057	0.636**		0.552**	0.601**	0.271
MAIA_SR		-0.066	0.267	0.652**	0.601**	0.769**		0.449
MAIA_BL		-0.066	0.267	0.652**	0.601**	0.769**		0.449*
MAIA_TR		-0.493*	0.483*	0.479*	0.271	0.531**	0.449*	

Note: Spearman's rho (ρ) correlations are reported; p-values were adjusted for multiple comparisons using the False Discovery Rate (FDR) correction according to Benjamini Hochberg procedure; significant correlations are those with FDR-corrected p-values <0.05

Acknowledgements: None.

Conflict of interest: None to declare.

Contribution of individual authors:

Veronica Raspa: conceptualization, methodology, data curation, formal analysis, writing and original draft.

Margherita Guercini: data curation, writing and original draft.

Ilaria Lupattelli: writing and original draft.

Patrizia Moretti: conceptualization, methodology, data curation and editing.

Claudia Mazzeschi, Laura Dalla Ragione & Alfonso Tortorella: conceptualization, review, editing.

All authors approved the final manuscript.

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Correspondence:

Veronica Raspa, PhD, Psychologist, Psychotherapist
Division of Psychiatry, Clinical Psychology, and Psychiatric Rehabilitation
of the General Hospital of Perugia
Perugia, Italy
E-mail: veronica.raspa1@unipg.it