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ORIGINAL ARTICLE

Emotional dysregulation, obsessive-compulsive traits, and eating disorders: three constructs for one spectrum?

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Abstract

Purpose Dysfunctional eating behaviors are associated with emotional dysregulation and obsessive-compulsive symptoms. Traditionally, obsessiveness has been linked to anorexia nervosa (AN), while dysregulation has been associated with bulimia nervosa (BN) and binge eating disorder (BED). However, this dichotomous view fails to account for the frequent diagnostic crossover observed among individuals with eating disorders (EDs). This study aimed to identify specific clusters in individuals with EDs based on emotional dysregulation, obsessive-compulsive symptoms, eating symptoms, and body uneasiness.

Methods An observational cross-sectional study was conducted at the ED Unit of Clinical Psychiatry, Bologna, Italy. Participants ($N=360$) completed the Difficulties in Emotion Regulation Scale (DERS), Obsessive Compulsive Inventory-Revised (OCI-R), Eating Disorders Examination Questionnaire (EDE-Q), and Body Uneasiness Test (BUT). Hierarchical and two-step cluster analyses were applied. Cluster differences were examined using Kruskal-Wallis tests and post-hoc comparisons.

Results The analysis identified three clusters with increasing levels of emotional dysregulation, obsessive-compulsive symptoms, eating symptoms, and body uneasiness (Cluster size ratio = 2.04; Silhouette = 0.30). Symptom severity ranged from more functional (Cluster 1) to moderate (Cluster 2) to more dysfunctional (Cluster 3).

Conclusion This study identified three clusters representing a progressive gradient in the symptoms assessed, challenging the traditional dichotomy linking obsessiveness solely to AN and dysregulation solely to BN/BED.

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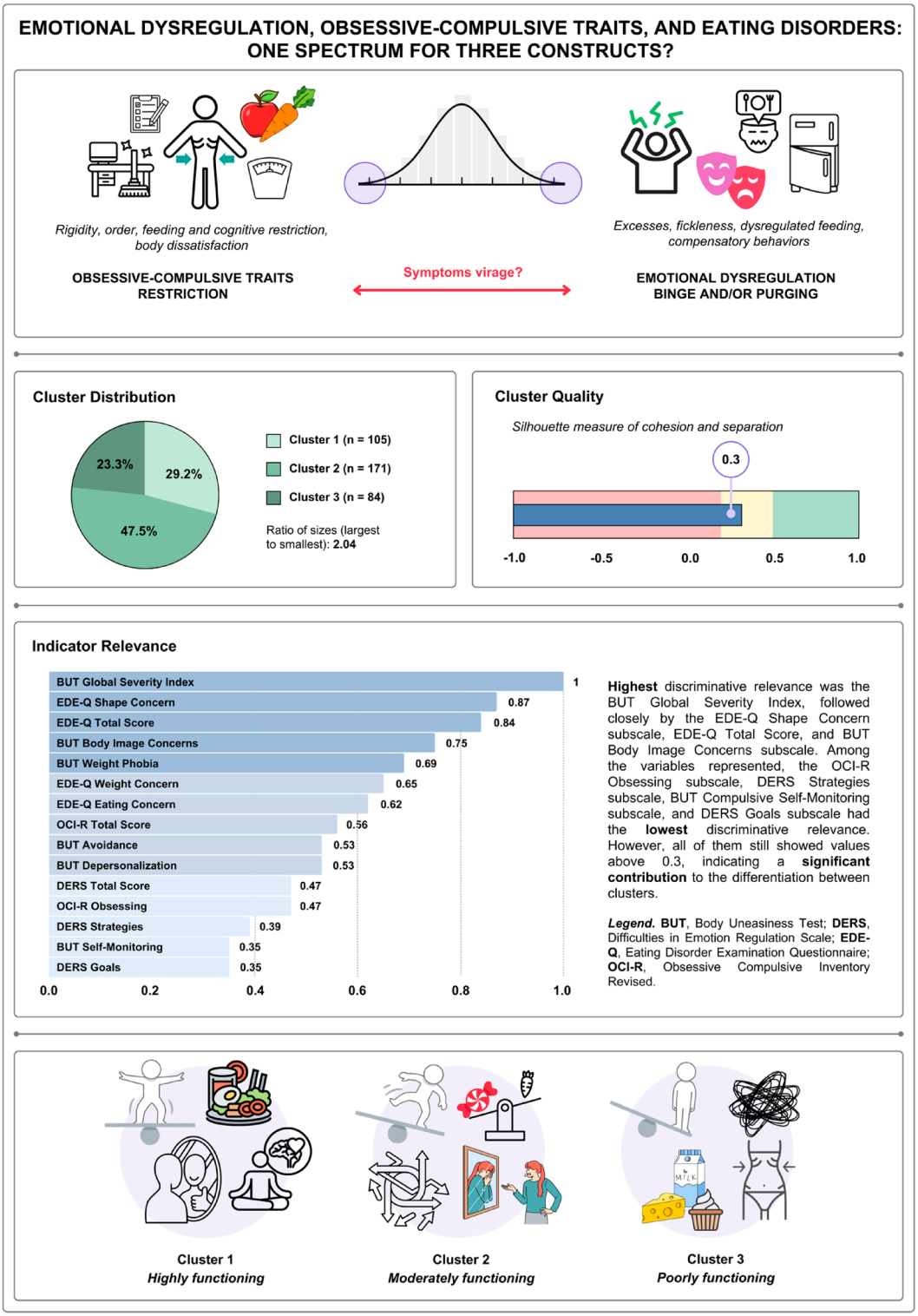
Graphical abstract



Keywords Emotional dysregulation · Obsessive-compulsive · Eating symptoms · Eating disorder · Cluster

Introduction

In recent decades, the epidemiology of eating disorders (EDs) has shifted: once predominantly associated with young Caucasian women, EDs have started to affect a broader demographic, and data today show an increase among males [1], sexual and gender minorities [2, 3], and various ethnic groups [4, 5]. Recent research suggests that the ED prevalence in the general population increased from 3.5% between 2000 and 2006 to 7.8% between 2013 and 2018 [6]. Moreover, the impact of the COVID-19 pandemic has also been meaningful, leading to a further rise in prevalence [7, 8]. This increase is particularly noteworthy, given that, due to factors such as reduced access to care and limited response to treatment, approximately 25% of individuals with EDs develop chronic conditions [9–11]. Despite the ever-changing landscape of EDs, difficulties in emotion regulation, spanning both dysregulation and hyper-regulation, persist as a central mechanism driving chronicity [12, 13].

Emotion regulation is a multidimensional and transdiagnostic construct involving the ability to understand, manage, and modulate emotional responses [14, 15]. These skills, acquired during development and shaped by sociocultural context, are essential for adaptive functioning [16, 17]. Emotional dysregulation, characterized by difficulties in managing emotions that interfere with goal-directed behavior [16], has been consistently linked to the development and maintenance of EDs [18–20]. When effective regulation strategies are lacking, individuals often resort to maladaptive coping behaviors, including obsessive-compulsive rituals or disordered eating, which provide short-term emotional relief but contribute to long-term maladjustment [21–23]. Research supports the theory that disordered eating behaviors serve as dysfunctional strategies to modulate overwhelming emotional experiences [12, 24–26], with higher emotional dysregulation associated with greater ED symptom severity, broader psychopathology, more dysfunctional personality traits, and poorer therapy outcomes [27–29].

Emotional dysregulation not only drives disordered eating behaviors but is also closely tied to the emergence of obsessive-compulsive traits and body image disturbances in EDs. Individuals with deficits in emotion regulation may engage in rigid control efforts over their internal states and external environment through compulsive rituals or perfectionistic behaviors, as a maladaptive way to manage emotional distress [30]. Body uneasiness, a central facet of the body image disturbances observed in individuals with EDs, often reflects this struggle for control and manifests as preoccupation with appearance, bodily functions, or specific body parts, extending beyond classical concerns with weight or shape [30, 31]. These interconnected mechanisms—emotional dysregulation, obsessive-compulsive traits, and body dissatisfaction—form a complex network of vulnerability factors in EDs.

Within this framework, EDs also demonstrate a high comorbidity with obsessive-compulsive disorder (OCD) [32, 33]. The association between EDs and obsessive traits has been explored for decades: already in 1986, during the DSM-III era, Rothenberg described EDs as a "modern version of obsessive-compulsive disorder," noting defensive patterns such as perfectionism, excessive orderliness, and meticulous attention to detail within both anorexia nervosa (AN) and bulimia nervosa (BN) [34]. Furthermore, both EDs and OCD share core psychopathological features, including repetitive thoughts, emotional preoccupations, and compensatory behaviors aimed at reducing distress [32]. This clinical overlap and high co-occurrence have led to proposals that EDs and obsessive-compulsive traits may belong to a broader common spectrum of disorders, potentially unified by shared etiological mechanisms [32, 35].

The present study aims to explore a large clinical sample of individuals with EDs to determine whether specific clusters could be identified based on emotional dysregulation, obsessive-compulsive symptoms, eating symptoms, and body uneasiness. Based on previous research [36, 37], it is hypothesized that distinct clusters will emerge, reflecting varying degrees of emotional dysregulation and associated differences in obsessive-compulsive symptoms, eating symptoms, and body uneasiness. To our knowledge, this is the first study to investigate these constructs in combination.

Methods

Study design and participants

An exploratory, observational, cross-sectional study was carried out between June 2018 and November 2023 by collecting data from individuals assessed consecutively at the ED Unit of Clinical Psychiatry, Study and Care Unit for ED, Department of Biomedical and Neuromotor Sciences/DIBINEM, University of Bologna, Italy. At the time of the assessment, all participants were asked to voluntarily provide written consent to use their clinical information for research purposes.

The sample included outpatients admitted to the unit and enrolled after completing informed consent, including authorization for data processing for research. Using the information from their medical records, we selected participants using the following inclusion criteria: (a) having been referred for an intake at the Unit of Clinical Psychiatry, Study and Care Unit for ED, and completed the assessment process and a semi-structured interview for diagnosis of ED, according to DSM-5 criteria, (b) >18 years of age

at the time of assessment, (c) good understanding of the Italian language, and (d) consent to participate in the study and written informed consent to use their data for research purposes.

The research conducted at the Complex Operational Unit "SPDC Maggiore," dedicated to the study and care of ED, aligns closely with the regional guidelines stipulated in "Dossier No. 240/2014 - Regional Program for ED - Contributions 2009–2012." The study was approved by the local Institutional Review Board (IRB) and conducted in accordance with the ethical principles outlined in the Declaration of Helsinki and according to the guidelines for Good Clinical Practice (GCP). This study collected both retrospective and prospective data, as approved by the Research Protocol (Identification No. 87153), on July 28, 2022.

Procedures and measures

The assessment process was conducted in two distinct sessions. In the first session, clinicians performed a clinical semi-structured interview aimed at gathering a comprehensive anamnesis, covering both somatic and psychological aspects of the patients' conditions. ED diagnoses were made by clinicians with expertise in the field, based on DSM-5 criteria and supported by the administration of validated psychometric questionnaires. In the second session, typically within two weeks, patients completed the full battery of standardized and validated questionnaires, including the Difficulties in Emotion Regulation Scale (DERS) to assess emotional dysregulation, the Obsessive-Compulsive Inventory-Revised (OCI-R) to evaluate obsessive-compulsive symptoms, and the Eating Disorders Examination Questionnaire (EDE-Q 6.0) along with the Body Uneasiness Test (BUT) to profile ED-specific symptomatology. Normally, treatment planning and prescription would follow the completion of this two-step assessment process. However, due to organizational challenges during the COVID-19 pandemic, there were occasional delays, and in some cases, the completion of assessments extended up to two months after the initial clinical interview.

Difficulties in Emotion Regulation Scale (DERS)

The DERS is a multidimensional, self-administered questionnaire consisting of 36 items [14] designed to assess trait-level emotion regulation. Higher scores indicate greater emotional dysregulation and impairment [38]. The DERS has good test-retest reliability and adequate construct and predictive validity when used with its total score [39]. The DERS measures six distinct but related factors of emotion regulation: Nonacceptance, which reflects the tendency to reject one's emotional responses; Goals, which assesses difficulty in engaging in goal-directed behavior when upset; Impulse, which measures problems with impulse control; Awareness, which evaluates a lack of emotional awareness (reverse-coded); Strategies, which reflects a perceived lack of effective strategies to regulate emotions, often accompanied by a feeling of powerlessness; and Clarity, which assesses the ability to understand and make sense of one's emotions [14].

Obsessive-Compulsive Inventory Revised (OCI-R)

The OCI-R is an 18-item self-report questionnaire designed to assess distress associated with obsessive-compulsive and hoarding symptoms, as defined by the DSM-5 [40]. The OCI-R can also be separated into two measures: one for OCD and one for hoarding disorder. For the OCD component, the score can range between 0 and 60, with higher scores indicative of more severe OCD symptoms. The scale demonstrates strong internal consistency across different populations and geographic locations and has been validated in Italy [41]. The OCI-R consists of six subscales, each containing three items: Washing, Checking, Obsessing, Ordering, Neutralizing, and Hoarding. It is designed to measure the severity of obsessive-compulsive and hoarding symptoms.

Eating Disorders Examination Questionnaire (EDE-Q 6.0)

The EDE-Q 6.0 is a self-administered questionnaire derived from the EDE, a structured interview considered the gold standard for assessing ED psychopathology [42]. Unlike the EDE, the EDE-Q does not require a trained examiner, making it more accessible, cost-effective, and less intrusive for the patient [43]. Respondents are asked to reflect on the previous four weeks, scoring items based on the frequency or occurrence of symptoms. Higher scores indicate more severe symptoms. The EDE-Q provides scores on four subscales: Restraint, Shape Concern, Weight Concern, and Eating Concern, which have all shown excellent internal consistency and test-retest reliability [44].

Body Uneasiness Test (BUT)

The BUT is a self-administered questionnaire designed to explore body dissatisfaction, avoidance behaviors, compulsive control behaviors, detachment from one's body, and specific concerns about body parts [45]. It consists of two sections: the BUT-A, which includes 34 items where participants rate how often each situation applies to them on a scale from 0 to 5, and the BUT-B, which assesses aversion to specific body parts. For this study, only the BUT-A was used, which measures the Global Severity Index and five

subscales: Weight Phobia, Body Image Concern, Avoidance, Compulsive Self-Monitoring, and Depersonalization. The Global Severity Index is calculated as the average score of all items, with higher scores indicating greater bodily distress [45].

Statistical analyses

Descriptive information was summarized as frequencies (N; %) for categorical variables and as mean and standard deviation (SD) for continuous variables. Analyses of continuous variables for skewness, kurtosis, and normality distribution were performed using the Shapiro-Wilk test to determine the appropriateness of parametric or non-parametric statistical tests. Outliers were checked across variables; minor outliers were detected only in the OCI-R and retained to preserve sample variability.

We performed a hierarchical cluster analysis using between-groups linkage and squared Euclidean distance to identify natural latent groupings within the dataset. Squared Euclidean distance was specifically chosen as the distance metric because all the indicator variables were continuous. This method employs an agglomerative hierarchical approach, where individual cases are progressively merged into clusters based on their similarity. The number of clusters was determined through visual inspection of the dendrogram. The indicator variables for the clustering procedure included emotional dysregulation (measured by DERS), obsessive-compulsive symptoms (measured by OCI-R), eating symptoms (measured by EDE-Q), and body uneasiness (measured by BUT).

The three-cluster solution was confirmed through two-step cluster analysis, including the automatic model selection procedure. Cluster quality was evaluated using the Silhouette index, with values closer to 1 indicating greater cohesion and separation between clusters [46]. Specifically, Silhouette values below 0.30 suggest a poor fit, values between 0.30 and 0.50 indicate a fair fit, and values above 0.50 reflect a good fit.

Quantitative measures (e.g., DERS, OCI-R, EDE-Q, and BUT) were compared using the Kruskal-Wallis test. If significant differences were detected, post-hoc pairwise comparisons were conducted using the Mann-Whitney U test for each group pair, adjusting the significance level using the Bonferroni correction (alpha level of 0.05 divided by the number of comparisons).

Finally, statistical analyses included a chi-square test to evaluate differences in the distribution of ED diagnoses across the identified clusters.

The analysis was conducted using SPSS 24 for Windows (IBM Corp., 2016).

Results

Characteristics of the sample

The sample of 360 individuals had a median age of 22 years (IQR: 20–30). Most participants were born in Italy (95.8%) and identified as female (91.1%). Educational attainment varied, with a majority of the sample holding a high school diploma (55%) or having college degrees (22.8%). Employment status showed that 50% of participants were students, while 37.5% were employed across various occupations.

Regarding the distribution of EDs, AN was the most prevalent diagnosis, with AN-R affecting 26.7% of the sample and AN-BP 8%. BN accounted for 30.5%, followed by BED at 17.2%, and OSFED at 10.3%. The median age of onset for ED symptoms was 17 years (IQR: 15–20), and the median BMI was 20.1 (IQR: 17.4–24.7). In terms of clinical characteristics, the DERS Total Score had a median of 110 (IQR: 87.5–128), while the OCI-R Total Score showed a median of 15 (IQR: 9–24). The EDE-Q Total Score had a median of 3.9 (IQR: 2.8–4.6), and the BUT Global Severity Index had a median of 2.8 (IQR: 2.1–3.5). For further details please refer to Table 1.

Clustering outcomes

A hierarchical cluster analysis was performed to identify distinct groups within the dataset. The analysis revealed a three-cluster solution as the most appropriate, based on the examination of the dendrogram (Fig. 1) and the agglomeration schedule coefficients, which indicated a clear increase in distance at the three-cluster solution. To further validate this finding, a two-step cluster analysis with automatic model selection was conducted, which confirmed the three-cluster solution as the best fit for the data.

This three-cluster model demonstrated a moderate ratio of cluster sizes (2.04), indicating a reasonable balance among cluster sizes, and achieved a Silhouette value of 0.30, indicating “fair” cohesion and separation. The clusters were interpreted as clinically meaningful, representing valuable indicators of symptom groupings. Figure 2 presents an ordered bar chart that illustrates the relative importance of each variable in the clustering process. These variable weights, ranging from 0 to 1, represent their discriminative power, with higher values signifying a lower likelihood that differences between clusters occurred by chance. The variable with the highest discriminative relevance was the BUT Global Severity Index, followed closely by the EDE-Q Shape Concern subscale, EDE-Q Total Score, and BUT Body Image Concerns subscale. Among the variables represented, the OCI-R Obsessing subscale, DERS Strategies subscale, BUT Compulsive Self-Monitoring subscale,

Table 1 Sample (N= 360) sociodemographic and clinical characteristics

Sociodemographic characteristics			
Variable	Minimum	Maximum	Median (IRQ)
Age (years old)	18	71	22 (20–30)
Variable	Answer	*n*	%
Country of birth	Italy	345	95.8
	Other	15	4.2
Gender	Female	328	91.1
	Male	31	8.6
	Non-binary	1	0.3
Educational attainment	Middle school diploma	73	20.3
	High school diploma	198	55
	College degrees	82	22.8
	Missing data	7	1.9
Employment status	Student	180	50
	Unemployed	31	8.6
	Office-based worker	66	18.3
	Field-based worker	8	2.2
	Others jobs	59	16.4
	Retired	2	0.6
	Missing data	14	3.9
Clinical characteristics			
Variable	Answer	*n*	%
ED	AN-R	96	26.7
	AN-BP	29	8
	AN Atypical	20	5.6
	BN	110	30.5
	BED	62	17.2
	ARFID	5	1.4
	RD	1	0.3
	OSFED	37	10.3
Variable	Minimum	Maximum	Median (IRQ)
Age ED onset (years old)	5	58	17 (15–20)
BMI (kg/m^2)	8.3	46.7	20.1 (17.4–24.7)
DERS			
• Total Score	45	163	110 (87.5–128)
• Clarity	5	25	15 (12–18)
• Impulse	6	29	17 (11.5–22)
• Nonacceptance	6	30	16 (11–24)
• Goals	5	25	17 (13–21)
• Awareness	7	30	16 (13.5–20)
• Strategies	8	39	25 (18–32)
OCI-R			
• Total Score	0	60	15 (9–24)
• Washing	0	12	1 (0–2)
• Checking	0	12	2 (0–3.5)
• Neutralizing	0	12	0 (0–1)
• Obsessing	0	12	5 (2–9)
• Ordering	0	12	3 (1–6)
• Hoarding	0	12	2 (0–4)
EDE-Q			
• Total Score	0.2	5.9	3.9 (2.8–4.6)
• Eating Concern	0	5.8	3.4 (2–4.2)
• Weight Concern	0	6	4 (3–4.8)
• Shape Concern	0	6	4.7 (3.4–5.3)

Table 1 (continued)

Variable	Minimum	Maximum	Median (IRQ)
• Restraint	0	6	3.6 (2–4.8)
BUT-A			
• Global Severity Index	0.1	4.9	2.8 (2.1–3.5)
• Weight Phobia	0	5	3.6 (2.6–4.3)
• Body Image Concerns	0	5	3.3 (2.3–4)
• Avoidance	0	4.8	2 (1–2.7)
• Self-Monitoring	0	5	2.4 (1.4–3.6)
• Depersonalization	0	5	2 (1.8–3)

AN-BP, Anorexia Nervosa Binge-Purging Type; AN-R, Anorexia Nervosa Restricting Type; ARFID, Avoidant/Restrictive Food Intake Disorder; BED, Binge Eating Disorder; BMI, Body Mass Index; BN, Bulimia Nervosa; BUT-A, Body Uneasiness Test; DERS, Difficulties in Emotion Regulation Scale; ED, Eating Disorder; EDE-Q, Eating Disorder Examination Questionnaire; OCI-R, Obsessive Compulsive Inventory Revised; OSFED, Other Specified Feeding or Eating Disorder; RD, Rumination Disorder; SD, Standard Deviation

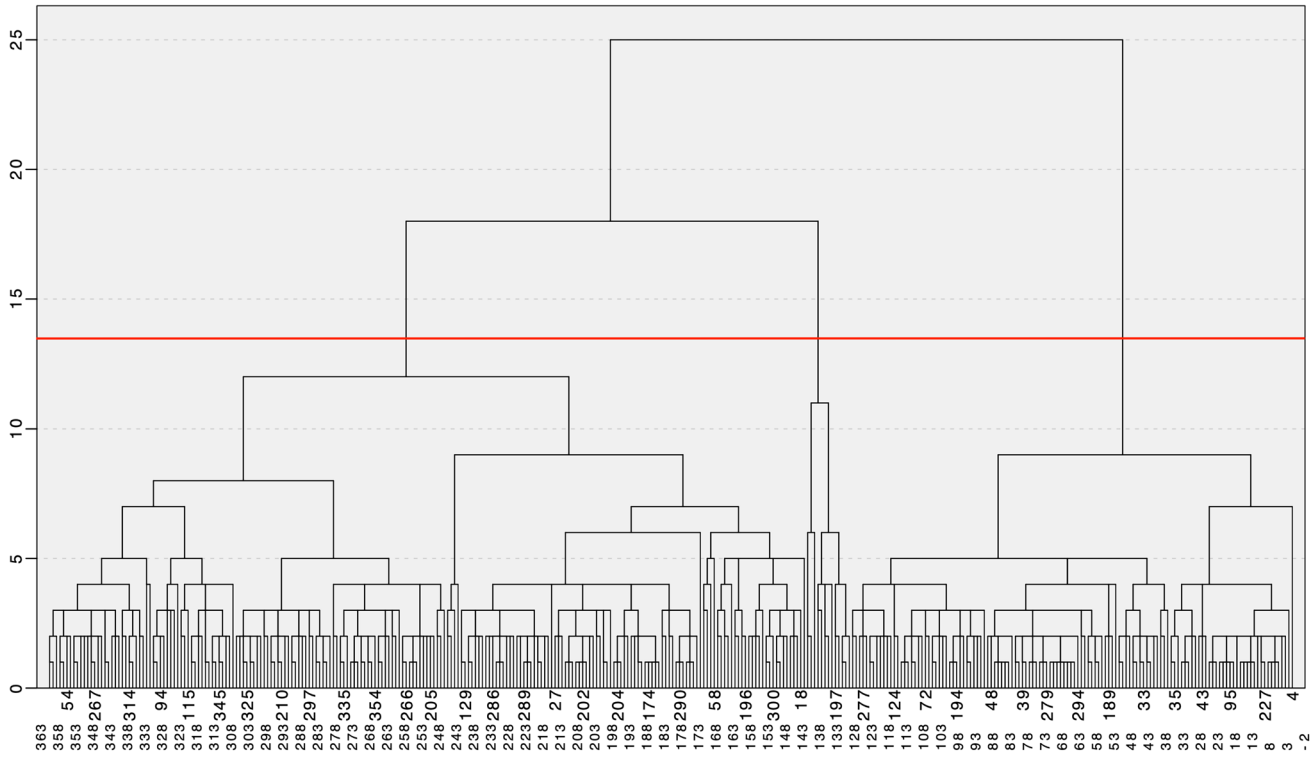


Fig. 1 Hierarchical clustering dendrogram illustrating the three-cluster solution among ED participants based on emotional dysregulation, obsessive-compulsive symptoms, eating symptoms, and body uneasiness.

and DERS Goals subscale had the lowest discriminative relevance. However, all of them still showed values above 0.3, indicating a significant contribution to the differentiation between clusters. The subscales with values below 0.3 were not represented because they did not demonstrate sufficient discriminative power to contribute to the differentiation between clusters.

Psychometric comparison between empirical groups

The results of the Kruskal-Wallis analyses revealed significant differences between clusters for the DERS Total Score ($\chi^2(2) = 154.284$, $p < .001$, $\eta^2 = 0.430$), OCI-R Total Score ($\chi^2(2) = 160.633$, $p < .001$, $\eta^2 = 0.447$), EDE-Q Total Score ($\chi^2(2) = 211.704$, $p < .001$, $\eta^2 = 0.590$), and BUT Global Severity Index ($\chi^2(2) = 248.223$, $p < .001$, $\eta^2 = 0.691$). Cluster 1 consistently showed the lowest symptom severity, Cluster 3 the highest, with Cluster 2 in between. Median values and interquartile ranges (IQRs) for the DERS Total Score, OCI-R Total Score, EDE-Q Total Score, and BUT Global Severity Index across the three clusters are reported in Table 2. All subscales showed significant differences between clusters, except for the DERS Awareness subscale.

The Mann-Whitney U tests compared the three clusters and revealed significant differences across all tested variables, specifically the main scores of the four scales. Between

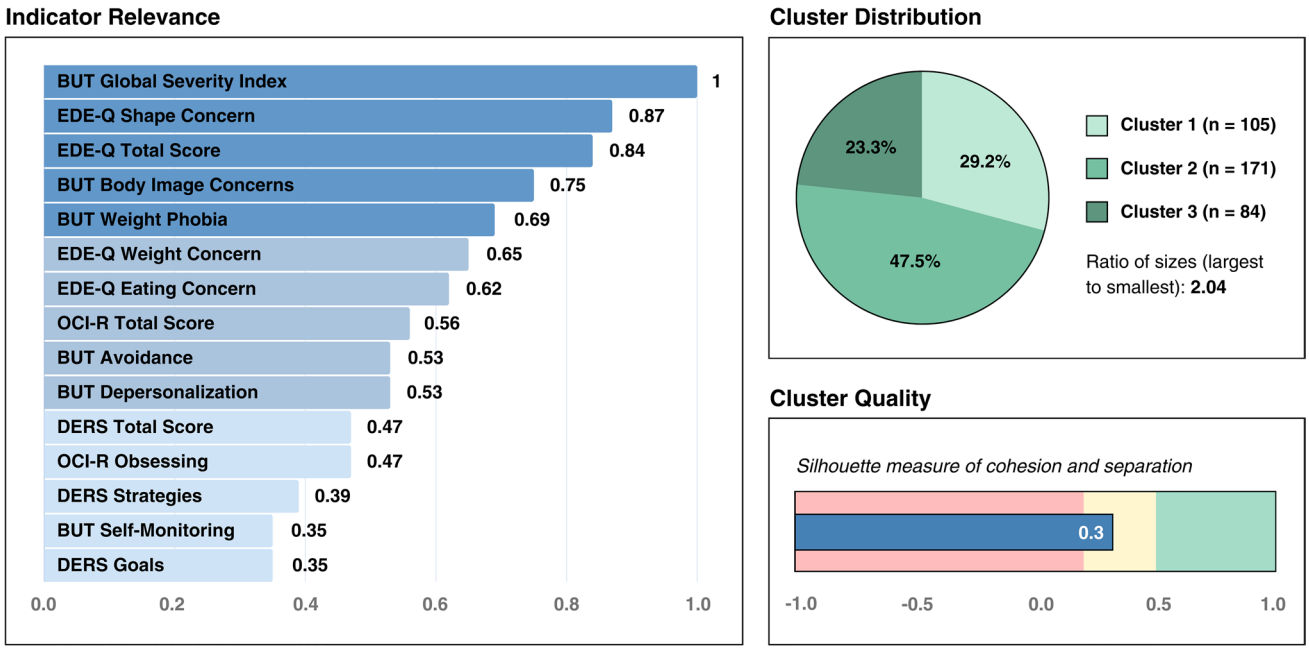


Fig. 2 Variable importance and cluster distribution in the three-cluster solution. Legend. BUT-A, Body Uneasiness Test; DERS, Difficulties in Emotion Regulation Scale; EDE-Q, Eating Disorder Examination Questionnaire; OCI-R, Obsessive Compulsive Inventory Revised

Clusters 1 and 2, significant differences were observed for the DERS Total Score (U =3892.000, p<.001), OCI-R Total Score (U =5910.500, p<.001), EDE-Q Total Score (U =740.500, p<.001), and BUT Global Severity Index (U =684.000, p<.001), indicating that Cluster 1 exhibited lower levels of emotional dysregulation, obsessive-compulsive symptoms, eating symptoms, and body uneasiness compared to Cluster 2. The comparison between Clusters 2 and 3 also yielded significant differences, with Clusters 2 and 3 showing significant results for DERS Total Score (U =2556.000 p<.001), OCI-R Total Score (U =868.500, p<.001), EDE-Q Total Score (U =3857.000, p<.001), and BUT Global Severity Index (U =1987.500, p<.001), indicating that Cluster 3 exhibited higher levels in all measures compared to Cluster 2. Finally, significant differences were found between Clusters 1 and 3 across all four variables, with results indicating that Cluster 1 had significantly lower scores in DERS Total Score (U =417.000, p<.001), OCI-R Total Score (U =584.000, p<.001), EDE-Q Total Score (U =199.500, p<.001), and BUT Global Severity Index (U =7.000, p<.001) compared to Cluster 3.

Clinical differences in BMI, age of onset, and ED diagnoses across clusters

Since BMI and age of onset demonstrated low discriminative importance in the preliminary clustering analysis (both <0.08), suggesting they did not meaningfully contribute to cluster differentiation, these variables were excluded from the final clustering procedure to preserve the robustness of the cluster solution. Nevertheless, we explored potential differences across the three clusters. Kruskal-Wallis analyses revealed significant differences between clusters for both BMI ($\chi^2(2)$ =14.002, p=.001, η^2 = 0.039) and age of onset ($\chi^2(2)$ =9.865, p=.007, η^2 = 0.027), indicating that, despite not influencing cluster formation, BMI and age of onset varied significantly across the identified groups. Median values and IQRs for BMI and age of onset are reported in Table 2.

Post-hoc analyses revealed that participants in Cluster 1 had the lowest median BMI (19.1 kg/m^2), while those in Cluster 2 had the highest (22 kg/m^2). Specifically, Mann-Whitney U tests showed significant differences in BMI between Cluster 1 and Cluster 2 (U =9101, p<.001) and between Cluster 1 and Cluster 3 (U =3936.5, p=.020), with no significant difference between Clusters 2 and 3.

Regarding age of onset, Cluster 2 participants exhibited the earliest median onset (16.5 years), compared to Cluster 1 (18 years) and Cluster 3 (17 years). Mann-Whitney U tests similarly indicated significant differences between Cluster 1 and Cluster 2 (U =5582, p=.002) and between Cluster 1 and Cluster 3 (U =2783, p=.024), with no significant difference observed between Clusters 2 and 3.

The distribution of diagnoses across the three clusters, analyzed using a chi-square test, revealed distinct patterns in ED prevalence (Cramer's V= 0.237, p<.001). In Cluster 1, the most prevalent diagnoses were AN binge-purging subtype (38.1%, 40 cases), BN (17.1%, 18 cases), and OSFED (14.3%, 15 cases). Cluster 2 was dominated by AN restrictive subtype (35.7%, 61 cases), followed by BN (35.7%, 61 cases) and BED (21.6%, 37 cases). In Cluster 3, the primary

Table 2 Summary of cluster characteristics: emotion dysregulation, Obsessive-Compulsive symptoms, eating disorder symptoms, and body uneasiness

Variabile	Cluster 1 (n = 105)	Cluster 2 (n = 171)	Cluster 3 (n = 84)	Kruskal-Wallis H test
	Median (IRQ)	Median (IRQ)	Median (IRQ)	p-value
DERS				
• Total Score	84 (73–101.5)	112 (97–124)	133 (124.3–144)	0.000
• Clarity	12 (10–15)	15 (12–18)	17 (14.3–21)	0.000
• Impulse	12 (10–15)	18 (13–21)	22.5 (18–26)	0.000
• Nonacceptance	12 (9–17)	17 (12–23)	25 (21.3–28)	0.000
• Goals	13 (10–17)	18 (15–20)	21 (19–23)	0.000
• Awareness	16 (13–20)	17 (14–20)	17 (14–20)	408.000
• Strategies	17 (14–23)	25 (21–30)	33.5 (29.3–36)	0.000
OCI-R				
• Total Score	9 (5–15)	14 (10–18)	32 (27–39)	0.000
• Washing	0 (0–1.3)	0 (0–2)	3 (1–5)	0.000
• Checking	1 (0–2.7)	1 (0–2.5)	4 (2–6)	0.000
• Neutralizing	0 (0–0.5)	0 (0–1)	2 (0–4)	0.000
• Obsessing	2 (1–4)	5 (3–8)	10 (8–12)	0.000
• Ordering	2 (0–4)	2 (1–4)	7 (4–10)	0.000
• Hoarding	1 (0–3)	2 (0–4)	5 (2.3–8)	0.000
EDE-Q				
• Total Score	2.1 (1.2–2.7)	4.1 (3.6–4.6)	4.9 (4.2–5.3)	0.000
• Eating Concern	1.6 (0.8–2.4)	3.6 (2.8–4.2)	4.4 (3.8–4.8)	0.000
• Weight Concern	2.2 (1.2–3.2)	4.4 (3.8–4.8)	5.1 (4.4–5.8)	0.000
• Shape Concern	2.6 (1.6–3.3)	4.9 (4.4–5.3)	5.8 (5.1–5.9)	0.000
• Restraint	1.4 (0.6–2.8)	3.8 (2.8–4.8)	4.4 (3.4–5.4)	0.000
BUT-A				
• Global Severity Index	1.5 (1.1–2)	3 (2.6–3.4)	3.9 (3.5–4.1)	0.000
• Weight Phobia	2 (1.4–2.6)	3.8 (3.1–4.3)	4.4 (4–4.6)	0.000
• Body Image Concerns	1.8 (1.1–2.3)	3.6 (3–4)	4.2 (3.7–4.4)	0.000
• Avoidance	0.7 (0.3–1.7)	2 (1.5–2.8)	3.3 (2.5–3.8)	0.000
• Self-Monitoring	1.2 (0.6–2.1)	2.8 (1.6–3.6)	3.8 (2.7–4.2)	0.000
• Depersonalization	1 (0.7–2)	2.5 (2–3)	3.8 (3–4)	0.000
BMI (kg/m^2)	19.1 (16–22.3)	22 (18.3–27.5)	20.7 (17.4–26.9)	0.001
Age of ED onset (years)	18 (15–22.5)	16.5 (14–19)	17 (15–20)	0.007

BMI, Body Mass Index; BUT-A, Body Uneasiness Test; DERS, Difficulties in Emotion Regulation Scale; ED, Eating Disorder; EDE-Q, Eating Disorder Examination Questionnaire; IRQ, Interquartile Range (Q1-Q3), range between the 25 th percentile (Q1) and the 75 th percentile (Q3); OCI-R, Obsessive Compulsive Inventory Revised

diagnoses were BED (36.9%, 31 cases), BN (36.9%, 31 cases), and AN binge-purging subtype (9.5%, 8 cases).

Discussion

The present study analyzed a sample of 360 individuals with EDs, revealing distinct profiles in emotional dysregulation, obsessive-compulsive symptoms, eating symptoms, and body uneasiness across three identified clusters. Cluster 1, the least severe one, consistently showed the lowest scores on all measured scales, suggesting lower levels of emotional dysregulation (DERS Total Score), obsessive-compulsive symptoms (OCI-R Total Score), eating symptoms (EDE-Q Total Score), and body uneasiness (BUT Global Severity Index) compared to Clusters 2 and 3. Cluster 2, with moderate severity, displayed moderate levels across these measures, whereas Cluster 3, the most severe and less functional, exhibited the highest scores, indicating more severe emotional, obsessive-compulsive, and body image-related difficulties. Statistical comparisons confirmed these trends, with most of the inter-cluster differences being significant (p<.001) across the DERS, OCI-R, EDE-Q, and BUT scores. These results support a gradient of symptom severity from Cluster 1 to Cluster 3. Additionally, although BMI and age of onset were not primary factors in cluster formation, significant differences emerged across clusters, with Cluster 1 showing lower BMI and later age of onset compared to the others. Distinct patterns of ED diagnoses were also observed, with AN-BP predominating in Cluster

1, AN-R in Cluster 2, and BED in Cluster 3. While our statistical results support the validity of the three-cluster model, we acknowledge that the modest silhouette score (0.30) suggests only fair separation between clusters. This model should therefore be interpreted with caution, as it seems to capture only a portion of the underlying heterogeneity within this population.

In the field of EDs, research has traditionally highlighted distinct patterns linking BN and AN with specific emotional and behavioral traits. Historically BN has been more closely associated with overall emotional dysregulation, particularly in impulse control [47–49]. By contrast, AN has typically been associated with obsessiveness, rigid control, and perfectionism [50, 51]. The theoretical formulations followed similar principles, arguing that patients with AN had difficulty forming mental representations of emotions and recognizing and expressing their emotional needs, concretely regulating this dysfunctional emotional experience through dietary restriction. Conversely, for patients with BN the negative emotional experience was thought to be more relevant, with patients attempting to distance themselves from emotions through binge eating or other impulsive behaviors [18]. However, this dichotomous view may oversimplify the complexity of the ED spectrum, and critics argue it lacks the nuance required to capture overlapping symptomatology, including shared elements of emotional dysregulation and obsessive tendencies [52]. Notably, there remains a lack of studies that fully examine how ED symptoms, emotional dysregulation, and obsessiveness intersect across diagnoses.

Advances in the conceptualization of emotional dysregulation within EDs suggest a shift from a diagnosis-specific to a transdiagnostic approach [47, 53]. Current research supports the idea that difficulties in emotion regulation are relevant across the entire ED spectrum [48, 51, 54]. This shift in perspective highlights emotional dysregulation as a common mechanism underlying various EDs, regardless of diagnosis, and moves away from rigid symptom-diagnosis correlations. Similarly, obsessive-compulsive traits and perfectionism, though conventionally more strongly associated with AN, appear to contribute to ED symptom severity more broadly, particularly among individuals who struggle with emotion regulation and lack adaptive coping strategies [55, 56]. Research indicates that high perfectionism, often linked to obsessive-compulsive tendencies, can drive rigid thought patterns and an unyielding pursuit of unrealistic standards [57]. These tendencies may be especially harmful for individuals unable to manage their emotions effectively, as they may adopt perfectionistic behaviors to exert control over body image, weight, or food intake in an attempt to reduce anxiety [22, 58].

Our study identified three distinct clusters characterized by varying levels of symptoms: a low-symptom cluster, a moderate-symptom cluster, and a high-symptom cluster. These three groups reflect a progressive increase in emotional dysregulation, obsessive-compulsive symptoms, eating pathology, and body uneasiness, with each construct rising in severity across the clusters. This seems to confirm the fact that individuals affected by emotional dysregulation may turn to perfectionistic behaviors as a mechanism to exert control or reduce anxiety, especially in relation to body image, weight, or food intake [58]. This mechanism could create a cyclical relationship where perfectionism intensifies eating symptoms, and these symptoms further exacerbate emotional dysregulation [55, 56]. Additionally, it is plausible that the obsessive-compulsive behaviors initially employed to maintain rigid control over emotions and body-related concerns may, over time, become less effective or destabilized, leading to episodes of emotional dysregulation characterized by impulsive or dysregulated behaviors [48, 59].

The clinical differences observed among the clusters, particularly regarding BMI, age of onset, and ED diagnoses, are consistent with and extend previous findings in the literature. Lower BMI and later onset, as seen in the less severe cluster, may reflect a more ego-syntonic presentation often reported in restriction phases, where rigid control mechanisms initially succeed in masking broader emotional dysregulation [60]. In contrast, earlier onset and higher BMI, associated with greater symptom severity, have been linked to more pervasive emotion regulation difficulties and impulsive behavioral patterns, as commonly observed in eating dysregulation [61, 62]. Early onset in particular has been considered a marker of greater vulnerability, associated with more severe and chronic clinical trajectories [63]. The diagnostic distribution across clusters supports the interpretation that individuals with restrictive AN, typically associated with greater cognitive control and emotional suppression, are more prevalent in the cluster characterized by moderate symptom severity [64], while diagnoses of BED and BN, reflecting a resurgence of emotional dysregulation and maladaptive attempts at self-regulation, were more frequent in the cluster with the most severe psychopathology [65].

These findings align with transdiagnostic models suggesting that emotional dysregulation, obsessiveness, and body image disturbances transcend traditional diagnostic boundaries, shaping the clinical expression of EDs across different subgroups [18, 36]. Accordingly, recognizing distinct symptom and clinical profiles may have important therapeutic implications: beyond complementing traditional categorical diagnostic systems [18, 66], a symptom-based approach could foster the development of more personalized treatment frameworks, specifically tailored to the psychological profiles of individuals, including those from minority and underrepresented groups [5, 67, 68]. By focusing

on the underlying emotional and behavioral mechanisms rather than solely on diagnostic labels, interventions could be more precisely targeted, potentially improving engagement, reducing chronicity, and enhancing overall treatment outcomes in individuals suffering from EDs.

To our knowledge, this is the first study to investigate these constructs in combination. Another strength of this study is its large sample size (360 participants) and the use of established, validated self-report measures (DERS, OCI-R, EDE-Q, and BUT). However, there are some limitations to consider. First, the cross-sectional nature of the study limits the ability to infer causality or determine the directionality of relationships between emotional dysregulation, obsessive-compulsive symptoms, and eating symptoms. Second, while the sample size is large, it is drawn from a single clinical setting in Bologna, Italy, which may limit the generalizability of the findings to broader populations or different cultural contexts. Lastly, the fair silhouette score (0.30) indicates only moderate cohesion and separation between clusters, suggesting that the identified model may capture the underlying clinical heterogeneity only partially. As this was an exploratory study, these findings should be interpreted with caution and considered as a preliminary framework. Future longitudinal studies are needed to validate the stability of these clusters over time and to explore causal relationships among the psychological dimensions assessed.

In conclusion, this study identified three distinct clusters in individuals with EDs, demonstrating an increasing gradient of emotional dysregulation, obsessive-compulsive symptoms, eating symptoms, and body uneasiness. The findings contradict the traditional dichotomy that associates obsessiveness with anorexic symptomatology and dysregulation with compulsive eating. Instead, they support classic psychiatric theories suggesting that obsessive symptoms may function as a form of emotion regulation, potentially linking these constructs [69]. A structured segmentation of the patient population in three clusters may suggest that adapted clinical interventions could be optimized by addressing the specific needs of each group, providing a targeted approach to treatment within this diverse sample. An important direction for future research is to improve our understanding of the role of emotional dysregulation and obsessive-compulsive traits by analyzing both the mechanisms shared by all EDs and those more specifically associated with individual diagnoses [13, 70, 71]. These findings highlight the importance of integrating the assessment of emotional dysregulation and obsessive-compulsive symptoms into clinical practice to better understand the psychological profiles of our patients and structure individualized interventions around them.

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Data availability The dataset analyzed during the current study is available from the corresponding author upon request.

Declarations

Competing interest F.F.A. received consultancy honoraria from Novo Nordisk.

Ethics approval This study complied with the Declaration of Helsinki and with the Italian privacy law, specifically the 'Code on the Protection of Personal Data (Legislative Decree 196/2003), updated with the new legislative decree (Legislative Decree 101/2018).' The statistical evaluation of collected data was carried out after complete anonymization. The study was approved by the local Institutional Review Board. The Research Protocol with the identification number 87153 was officially approved on July 28, 2022.

Patient consent statement At the time of the assessment, all participants were asked to voluntarily provide written consent to use their clinical information for research purposes.

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