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FULL-LENGTH REPORT

Emotional regulation in eating disorders and gambling disorder: A transdiagnostic approach

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ABSTRACT

Background and aims: Difficulties in Emotion Regulation (ER) are related to the etiology and maintenance of several psychological disorders, including Eating Disorders (ED) and Gambling Disorder (GD). This study explored the existence of latent empirical groups between both disorders, based on ER difficulties and considering a set of indicators of personality traits, the severity of the disorder, and psychopathological distress. *Methods:* The sample included 1,288 female and male participants, diagnosed with ED (n = 906) and GD (n = 382). Two-step clustering was used for the empirical classification, while analysis of variance and chi-square tests were used for the comparison between the latent groups. *Results:* Three empirical groups were identified, from the most disturbed ER profile (Subgroup 1) to the most functional (Subgroup 3). The ER state showed a linear relationship with the severity of each disorder and the psychopathological state. Different personality traits were found to be related to the level of emotion dysregulation. *Discussion and conclusion:* In this study, three distinct empirical groups based on ER were identified across ED and GD, suggesting that ER is a transdiagnostic construct. These findings may lead to the development of common treatment strategies and more tailored approaches.

KEYWORDS

eating disorders, gambling disorders, emotion regulation, transdiagnostic

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INTRODUCTION

Over the years, the study of mental and behavioral disorders has evolved from a categorical diagnostic approach to a dimensional one. For it organization, The International Classification of Diseases 11th Revision (ICD-11) has deepened in shared etiological and

phenomenological factors among disorders (Reed et al., 2019). Incorporating the description of clinical features that are not diagnostically determinative but are frequently associated with the disorders helps to recognize their variations across disorders (First, Reed, Hyman, & Saxena, 2015). This has reopened the discussion regarding whether large clusters of diagnoses can be identified by shared external validating factors rather than by symptom pictures alone (Andrews et al., 2009).

Emotion Regulation (ER) has been defined as a set of strategies that are used to manage and modulate an affective experience (Gratz, Weiss, & Tull, 2015; Gross, 2015), including awareness, acceptance and clarity of emotions, and access to effective goal-directed behaviors (Gratz & Roemer, 2004). Conversely, emotion dysregulation includes the frequent use of maladaptive strategies, such as avoidance and suppression (Sloan et al., 2017).

ER and dysfunctional emotional processing are related to the etiology and maintenance of several psychological disorders, including eating disorders (ED) (Brockmeyer et al., 2014; Henderson, Fox, Trayner, & Wittkowski, 2019; Kanakam, Krug, Raoult, Collier, & Treasure, 2013; Wolz et al., 2015), gambling disorder (GD) (Estévez et al., 2020; Granero et al., 2018; Sancho et al., 2019; Williams, Grisham, Erskine, & Cassedy, 2012), borderline personality disorder (Cackowski et al., 2014; Van Zutphen et al., 2018), anxiety (Cisler & Olatunji, 2012), depression (Joormann & Stanton, 2016), compulsive buying disorder (Estévez et al., 2020), and other behavioral addictions (Estévez, Jáuregui, Sánchez-Marcos, López-González, & Griffiths, 2017). Improvements in ER are associated with a reduction in psychopathological symptoms (Axelrod et al., 2011; Gratz et al., 2015; Khakpoor et al., 2019; Mallorquí-Bagué et al., 2018; Neacsiu et al., 2014; Sloan et al., 2017) and a better therapy outcome (Oldershaw et al., 2018; Mallorquí-Bagué et al., 2018; Norton & Paulus, 2016).

These studies suggest that ER could be an underlying transdiagnostic trait and behavioral endophenotype across different disorders (Kanakam et al., 2013; Sloan et al., 2017). However, to date, no studies have jointly evaluated a clinical population of different entities with the aim of finding possible sub-empirical groups based on ER difficulties in order to clarify whether emotional regulation can be regarded as a transdiagnostic construct.

Emotion dysregulation has been hypothesized to be a common risk trait for externalizing disorders such as ED, Substance Use Disorders (SUD), and addictive behaviors such as GD, being suggested that the performance of the disorder-related behaviors could be used to cope with negative emotional states (Aldao, Nolen-Hoeksema, & Schweizer, 2010; Estévez et al., 2017; Kassel, Veilleux, Heinz, Braun, & Conrad, 2013; Leehr et al., 2015).

Among these conditions, ED and GD have been studied together due to the prevalence of comorbidity between them (Jiménez-Murcia et al., 2013; Von Ranson, Wallace, Holub, & Hodgins, 2013) and their commonalities, considering psychological and neurobiological characteristics, personality traits, and ER processes (Álvarez-Moya et al., 2007; Claes et al., 2012; Del Pino-Gutiérrez et al., 2017; Jiménez-Murcia et al., 2015; Kim, von Ranson, Hodgins, McGrath, & Tavares, 2018; Lesieur & Blume, 1993). However, no research has directly addressed the hypothesis of whether ER could be a transdiagnostic construct between these conditions, considering jointly clinical samples of both disorders.

GD is considered to be a mental disorder characterized by recurrent gambling behaviors that become persistent over time, despite their negative consequences (American Psychiatric Association, 2013). Gambling activities may be divided into Strategic, where the gambler can use knowledge of the game to influence or predict the outcome, and Non-Strategic, which implies little or no possibility of influencing the outcome (Potenza et al., 2001; Potenza, Steinberg, McLaughlin, Rounsaville, & O'Malley, 2000). Among ED, anorexia nervosa (AN) and bulimia nervosa (BN) are characterized by the overvaluation of weight and shape and extreme weight control behaviors (e.g., self-starvation in AN and a cycle of binge eating and purging in BN). Binge Eating Disorder (BED) implies recurrent binge eating without compensatory weight loss behaviors. Patients whose problems are less well conceptualized receive the diagnosis of Other Specified Feeding or Eating Disorder (OSFED) (American Psychiatric Association, 2013).

Dysfunctional emotional processing in AN includes rumination and avoidance and lack of emotional awareness (Aldao et al., 2010; Monell, Clinton, & Birgegård, 2018; Kolar et al., 2019). In contrast, in patients with externalizing disorders such as BN or BED, compulsive binge episodes or excessive exercise are frequently adopted as maladaptive strategies to cope with negative emotions (Engel et al., 2013). In a similar way, pathological gamblers often report using gambling to escape from negative mood states (Blaszczynski & McConaghy, 1989; Getty, Watson, & Frisch, 2000). Dysfunctional ER is associated with a higher severity of eating disorders (Claes et al., 2012; Rodríguez-Cano, Beato-Fernandez, Rojo-Moreno, & Vaz-Leal, 2014; Wolz et al., 2015) and a poor response to therapy in patients with GD or ED (Bodell et al., 2019; Mallorquí-Bagué et al., 2018; Steward et al., 2020).

The neural networks involved in dysfunctional emotional processing have been extensively described (Brandl, Le Houcq Corbi, Mulej Bratec, & Sorg, 2019; Liu, Peeters, Fernández, & Kohn, 2020; Raschle et al., 2019; Kucharska et al., 2019), with increasing evidence showing similar neurobiological features (Mallorquí-Bagué et al., 2020; Navas et al., 2017; Steward et al., 2019, 2020) and reward processing (Balodis et al., 2012, 2013) between ED and GD although, there are no studies directly comparing the two populations.

Similar personality traits are related to problems in ER in both disorders. In ED high harm avoidance, impulsivity, and low self-directedness are common (Agüera et al., 2019; Atiye, Miettunen, & Raevuori-Helkamaa, 2015; Mikhail & Kring, 2019; Wolz et al., 2015). High novelty seeking and a lack of emotional control and planning are associated with maladaptive emotion expression (e.g., anger expression and lack of anger control) in GD and ED, particularly the binge-

purging subtypes of ED (e.g., BN or BED) (Aymamí et al., 2014; Maniaci et al., 2017; Tárrega et al., 2015), as well as with emotional dysregulation (Pettorruso et al., 2020).

Despite what has been mentioned above, there is a lack of research directly investigating a transdiagnostic approach regarding ER in both disorders. Transdiagnostic approaches in mental health that include the identification of different phenomenological constructs, such as ER, in order to identify clinical phenotypes could complement and deepen diagnosis, prediction, and treatment research (Nelson, McGorry, & Fernandez, 2020; Shah et al., 2020).

Therefore, the aim of the present study was to explore in a large clinical sample of patients with ED and GD to determine whether specific clusters based on ER difficulties, personality traits, disorder severity, and general psychopathology could be identified. From the pre-existing literature (Kanakam et al., 2013; Sloan et al., 2017), we hypothesized that it would be possible to identify different clinical groups defined by the degree of ER difficulties, and that these would be related to the severity of the disorder symptomatology, general psychopathology, and personality traits. Identification of similar specific phenotypes in two related disorders would validate a transdiagnostic construct that might have implications for common treatment approaches in both disorders. To the best of our knowledge, this is the first study to investigate if ER is a transdiagnostic construct across these disorders, considering the joint evaluation of different clinical samples, which may fill a gap in the pre-existing literature.

MATERIALS AND METHODS

Participants

The sample consisted of 1,288 participants with ED (n = 906) and GD (n = 382) diagnoses, 584 females (n = 44 with GD and n = 810 with ED) and 434 males (n = 338 with GD and n = 96 with ED). The diagnostic distribution for ED was 172 participants with AN, 280 with BN, 129 with BED, and 325 with OSFED; meanwhile, the distribution for GD was 212 participants with Non-Strategic gambling only (Non-Strategic), 93 with Strategic gambling only (Strategic), and 77 participants with both Non-Strategic and Strategic gambling (Both). All participants included in the study were diagnosed according to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) criteria (American Psychiatric Association, 2013), and consecutively referred for assessment and treatment between April 2014 and July 2019.

Assessment

The assessment included a specific sociodemographic questionnaire and the following instruments.

Difficulties in Emotion Regulation Strategies (DERS). (Gratz & Roemer, 2004), which is a 36-item scale used for the evaluation of emotion dysregulation that has been validated in a Spanish population (Wolz et al., 2015). The DERS consists of six subscales: Non-acceptance of emotional responses, difficulties engaging in goal-directed behavior when having strong emotions, impulse-control difficulties, lack of emotional awareness, limited access to emotional regulation strategies, and lack of emotional clarity. Participants are asked to respond to each item using a five-point Likert scale ranging from 1 (almost never) to 5 (almost always). Higher scores indicate greater problems with ER. The internal consistency of the DERS total score in our sample was excellent (α = 0.94) and, for the first-order subscales, it ranged between α = 0.76 (for limited access to emotional regulation strategies) to α = 0.91 (impulse-control difficulties).

Temperament and Character Inventory–Revised (TCI-R). (Cloninger, 1999), which is a 240-item questionnaire with a five-point Likert scale format. It measures four temperaments (harm avoidance, novelty seeking, reward dependence, and persistence) and three character dimensions (self-directedness, cooperativeness, and self-transcendence). This questionnaire has been validated in a Spanish adult population (Gutiérrez-Zotes et al., 2004). The Cronbach's alpha for the different scales in the current sample ranged from α = 0.79 (for novelty seeking) to α = 0.90 (for harm avoidance).

Symptom Checklist-90 Items-Revised (SCL-90-R). (Derogatis, 1994), which is a 90-item questionnaire used for assessing self-reported psychological distress and psychopathology. It evaluates nine primary symptom dimensions: Somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism, as well as three global indices: Global Severity Index (GSI), Positive Symptom Total (PST), and Positive Symptom Distress Index (PSDI). This instrument has been validated in a Spanish population (Derogatis, 2002). The internal consistency of the subscales in our sample ranged from α = 0.78 (for paranoid) to α = 0.98 (for the global indexes).

Eating Disorder Inventory-2 (EDI-2), which is a 91-item multidimensional self-report questionnaire that assesses psychological and behavioral characteristics relevant to eating disorders. The questionnaire consists of 11 subscales, answered on a six-point Likert scale: Drive for thinness, body dissatisfaction, bulimia, ineffectiveness, perfectionism, interpersonal distrust, interoceptive awareness, maturity fears, asceticism, impulse regulation, and social insecurity. This instrument have been validated in a Spanish population (Garner, 1998). The internal consistency of the EDI-2 total score in our sample was α = 0.95.

South Oaks Gambling Severity Screen (SOGS-GD). (Lesieur & Blume, 1987), which is a 20-item self-report scale for screening current problem gambling severity during the last 12 months, and has been validated for a Spanish population (Echeburúa, Báez, Fernández, & Páez, 1994). The scale's internal consistency in our study sample was α = 0.74.

Diagnostic Questionnaire for Pathological Gambling (According to the DSM Criteria). (Stinchfield, 2003), which is a self-report questionnaire that identifies the presence of GD

through 19 items that measure the DSM criteria for the DSM-IV-TR (American Psychiatric Association, 2010) and the DSM-5 (American Psychiatric Association, 2013) versions. The questionnaire has been validated in a Spanish population (Jiménez-Murcia et al., 2009). The internal consistency for this scale in our study sample was $\alpha = 0.78$.

Other socioeconomic measures. Additional information was collected through a semi-structured interview with the clinicians. This interview included sex, age, and education level. The Hollingshead survey was also completed to calculate the socioeconomic position index, based on the retired/employed status, educational attainment, and occupational position (Hollingshead, 2011).

STATISTICAL ANALYSIS

The analysis was carried out using SPSS24 for windows (IBM Corp., 2016). The clustering two-step analysis procedure, an exploratory method to identify natural latent groupings within a dataset of continuous and categorical features, based on the agglomerative hierarchical clustering method and assuming a joint multinomial-normal distribution was used. This analysis produces an automatic determination of the optimal number of latent groups, and in this study, the log-likelihood distance and the Schwarz Bayesian Information Criterion (BIC) was used. The set of indicator variables for the clustering procedure carried out included the emotional regulation profile (DERS scores), the severity of the disorder (measured with the EDI-2 total for ED and the number of DSM-5 criteria for GD), personality traits (TCI-R scores), and global psychological distress (SCL-90R GSI). The cluster quality for the final model was estimated with the Silhouette index, which constitutes a global consistency measure of the cohesion/separation (Rousseeuw, 1987). Silhouette values fall within the range of −1 to +1: High values are interpreted as adequate matching in one's own cluster (that is, individuals within a latent cluster are similar) and as poor matching in other clusters (individuals within a latent cluster are different compared to the other clusters). Values lower than 0.30 are interpreted as having a poor fit, between 0.30 and 0.50 as fair, and higher than 0.50 as good.

Chi-square tests (χ^2) were used to compare the categorical variables between the identified latent empirical groups, while the quantitative measures were compared by analysis of variance (ANOVA). To estimate the effect size for the proportion differences, Cohen's h was obtained as the difference between the arcsine transformation for the probabilities calculated in each group (poor–low effect size was considered for $|h| > 0.20$, moderate–medium for $|h| > 0.5$, and large–high for $|h| > 0.80$) (Cohen, 1988). Since multiple statistical tests were performed, a possible increase in Type-I error was controlled for using Finner's method, a stepwise familywise error rate characterized by providing more powerful capacity than the classical Bonferroni correction (Finner, 1993).

Procedure and ethics

All participants in our sample voluntarily sought treatment for GD and ED and were diagnosed according to the DSM-5 criteria (American Psychiatric Association, 2013) by clinical psychologists and psychiatrists with more than 15 years of experience in the field of behavioral addictions and eating disorders. They conducted two face-to-face clinical interviews, before and after a psychometric evaluation. The first appointment consisted of a clinical interview, and in the subsequent visit, the results of the tests and information about the treatment according to their clinical profile were shared. The psychometric evaluation was based on specific pencil and paper tests and self-reports. The patients included in this study did not receive any kind of compensation for their participation.

According to the Declaration of Helsinki, the present study was approved by the appropriate research committee. Written and signed informed consent was obtained from all participants.

Ethics

According to the Declaration of Helsinki, the present study was approved by the Clinical Research Ethics Committee (CEIC) of Bellvitge University Hospital, and written and signed informed consent was obtained from all participants.

RESULTS

Characteristics of the sample

Within the GD subsample, most participants were men (n = 338, 88.5%), whereas in ED most were women (n = 810, 89.4%). The mean age of the GD patients was higher than that of the ED patients [40.5 years (SD = 13.4) for GD and 30.7 years (SD = 12.1) for ED]. The age of onset of gambling activity [24.8 years (SD = 10.4)], was later compared to the age of onset of eating problems [20.2 years (SD = 8.8)].

The GD patients were predominantly single (n = 177, 46.3%) or married (n = 169, 44.2%), while most of the ED participants were single (n = 647, 71.4%). The social position index was low for both disorders (n = 192, 50.3% for GD n = 492, 54.3% for ED), and employment status was similar between groups (n = 231, 60.5% for GD and n = 511, 56.4% for ED), as well as the education level (primary studies, n = 257, 67.3% for GD and primary or secondary education levels, n = 744, 82.2% for ED).

Table S1 (in the Supplementary Materials) includes the descriptive data for all of the variables analyzed in the study, as well as a comparison between both subsamples.

Clustering outcomes

The solution selected as the optimal in the two-step cluster procedure was for three latent empirical groups. This achieved the highest ratio distance measure (2.587) and a cohesion/separation index into the fair range (silhouette =

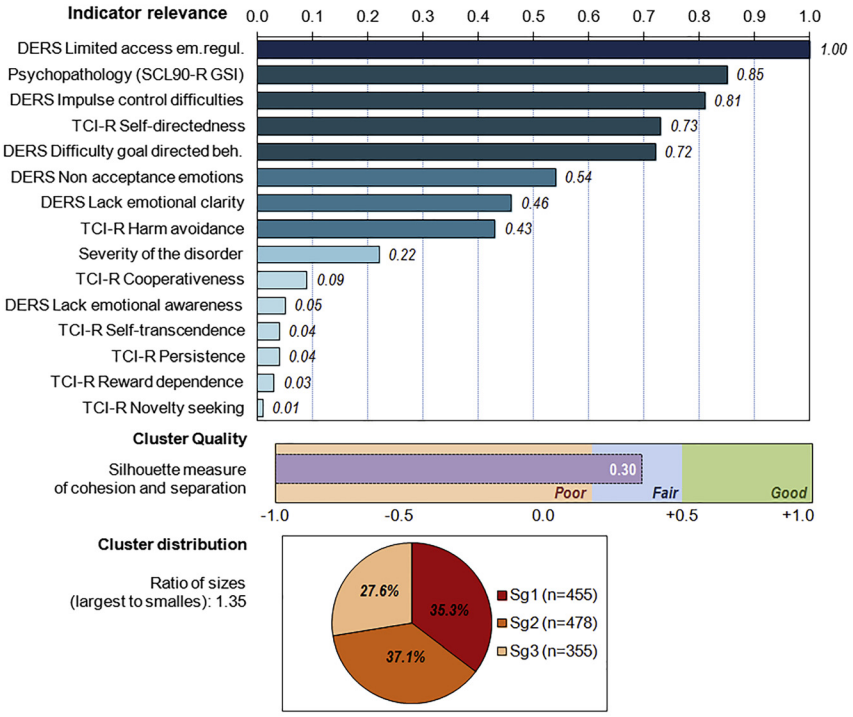

Fig. 1 Summary for the clustering

Note. Sg1: Subgroup 1. Sg2: Subgroup 2. Sg3: Subgroup 3. DERS: Difficulties in Emotion Regulation Strategies. SCL-90: Symptom Checklist-90 Items-Revised. TCI-R: Temperament and Character Inventory–Revised.

0.40). This three-group model was selected as the most favorable in this work, since it achieved reliable interpretation of the results in clinical terms. Table S2 (in the Supplementary Materials) includes the complete results of the auto-clustering.

The first panel of Fig. 1 displays the ordered bar chart with the relative relevance for each measure used in the clustering. These weights were in the range 0 to +1, and they were interpreted as a measure of the discriminative capacity of each variable within the classification (greater values are related to a lower likelihood that changes between clusters are attributable to chance). The measure with the greatest discriminative relevance (plotted with the darkest bar) was the DERS subscale "limited access to emotional regulation strategies," closely followed by psychopathological distress, impulse control difficulties (DERS), self-directedness (TCI-R), and difficulties engaging in goal-directed behaviors (DERS). The lowest discriminative relevance was for the lack of emotional awareness (DERS), followed by four TCI-R scales (self-transcendence, persistence, reward dependence, and novelty seeking).

The second and third panels of Fig. 1 show graphical images of the cluster quality (silhouette measure) and the cluster distribution in the three empirical latent groups (the ratio of the largest versus the smallest sizes was 478/355 = 1.35), respectively.

Comparison between empirical groups

Table 1 displays the distribution of the variables analyzed in the study within the three latent empirical groups identified in the two-step procedure, as well as a statistical comparison between the groups. These results provide a quantitative summary of the phenotypes associated with each empirical group. Patients in subgroup 1 (Sg1; n = 455, 35.3%) were young with a shorter duration of the problematic behavior, as well as an earlier age of onset, a higher severity of the disorder, the poorest emotion regulation profile, and more extreme personality traits of harm avoidance and self-transcendence. This subgroup included a higher proportion of single women, with secondary education.

Subgroup 2 (Sg2; n = 478, 37.1%) was in the middle range of clinical features and personality traits. Two thirds of this group were women, mostly single, employed, with low education levels and low social indexes.

On the contrary, subgroup 3 (Sg3; n = 355, 27.6%) comprised older men, with a later onset of the disorder, which was protracted but with low severity. This subgroup had a more functional emotion regulation profile and higher personality traits of reward dependence, persistence, self-directedness, and cooperativeness, as well as the lowest mean in self-transcendence. Participants in this group were not in relationships (single or divorced), employed, and had the highest education levels and social indexes.

Figure 2 displays a radar plot of the distribution of the mean scores of the variables distinguished in the empirical groups (z-standardized values are shown). Figure 3 contains line charts, when considering normative scores, with the prevalence of the participants within the clinical range, in terms of severity level of the disorder, emotion regulation (DERS), psychopathological state (SCL-90R), and personality traits (TCI-R). These graphics represents a visual

Table 1. Comparison between the empirical groups in sociodemographical and clinical variables, psychopathology, personality traits and emotional disregulation

	Sg1 (n = 455)		Sg2 (n = 478)		Sg3 (n = 355)		Group		Sg1 vs Sg2		Sg1 vs Sg3		Sg2 vs Sg3	
	n	%	*n*	%	*n*	%	*P*		*P*	|*d*|	*P*	|*d*|	*P*	|*d*|
Sex														
Women	365	80.2%	313	65.5%	176	49.6%	**<0.001***		**<0.001***	0.33	**<0.001***	**0.66**†	**<0.001***	0.32
Men	90	19.8%	165	34.5%	179	50.4%								
Marital														
Single	330	72.5%	295	61.7%	199	56.1%	**<0.001***		**0.002***	0.23	**<0.001***	0.35	0.253	0.12
Married/Partner	96	21.1%	139	29.1%	120	33.8%				0.18		0.29		0.10
Divorced/Separated	29	6.4%	44	9.2%	36	10.1%				0.11		0.14		0.03
Education														
Primary	210	46.2%	261	54.6%	168	47.3%	0.089		**0.035***	0.17	0.790	0.02	0.108	0.15
Secondary	173	38.0%	151	31.6%	127	35.8%				0.14		0.05		0.09
University	72	15.8%	66	13.8%	60	16.9%				0.06		0.03		0.09
Social index														
High	8	1.8%	6	1.3%	6	1.7%	**0.040***		0.821	0.04	**0.037***	0.01	**0.010***	0.04
Mean-high	34	7.5%	44	9.2%	30	8.5%				0.06		0.04		0.03
Mean	58	12.7%	56	11.7%	52	14.6%				0.03		0.06		0.09
Mean-low	101	22.2%	102	21.3%	107	30.1%				0.02		0.18		0.20
Low	254	55.8%	270	56.5%	160	45.1%				0.01		0.22		0.23
Employ.														
Unem./student	209	45.9%	201	42.1%	136	38.3%	0.092		0.232	0.08	**0.029***	0.15	0.277	0.08
Employed	246	54.1%	277	57.9%	219	61.7%								
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*LT*	*QT*	*P*	|*d*|	*P*	|*d*|	*P*	|*d*|
Age (yrs)	31.3	12.7	33.8	12.8	36.2	14.3	**<0.001***	0.922	**0.003***	0.20	**<0.001***	0.37	**0.009***	0.18
Onset disorder (yrs)	19.9	8.5	22.0	9.8	23.1	10.1	**<0.001***	0.388	**0.001***	0.23	**<0.001***	0.34	0.091	0.11
Duration disorder (yrs)	11.3	10.7	11.8	10.6	13.1	11.8	**0.026***	0.534	0.498	0.05	**0.023***	0.16	0.097	0.11
Severity of disorder (EDI-2 for ED and SOGS and DSM criteria for GD)	96.9	6.4	88.1	13.6	77.3	21.6	**<0.001***	0.255	**<0.001***	**0.83**†	**<0.001***	**1.23**†	**<0.001***	**0.59**†
DERS Non-accept-em	23.9	4.9	18.1	5.5	12.1	5.1	**<0.001***	0.744	**<0.001***	**1.12**†	**<0.001***	**2.37**†	**<0.001***	**1.14**†
DERS Diff-direct-beh	20.8	3.0	15.9	3.8	11.0	3.6	**<0.001***	0.844	**<0.001***	**1.43**†	**<0.001***	**2.95**†	**<0.001***	**1.31**†
DERS Limit-emot-reg	17.6	5.2	18.6	4.6	15.7	4.6	**<0.001***	**<0.001***	**0.001***	0.21	**<0.001***	0.39	**<0.001***	**0.64**†
DERS Lack-emot-awar	31.5	4.8	22.4	5.1	13.7	4.1	**<0.001***	0.411	**<0.001***	**1.86**†	**<0.001***	**4.02**†	**<0.001***	**1.89**†
DERS Impulse-cont-dif	21.7	4.8	14.1	4.0	9.8	2.8	**<0.001***	**<0.001***	**<0.001***	**1.72**†	**<0.001***	**3.03**†	**<0.001***	**1.24**†
DERS Lack-emot-clar	17.0	4.3	13.8	3.9	9.1	3.0	**<0.001***	**0.001***	**<0.001***	**0.78**†	**<0.001***	**2.11**†	**<0.001***	**1.34**†
DERS Total score	132.5	13.9	102.8	12.9	71.5	12.7	**<0.001***	0.285	**<0.001***	**2.21**†	**<0.001***	**4.57**†	**<0.001***	**2.45**†
SCL-90R Somatic	2.24	0.83	1.47	0.80	0.82	0.72	**<0.001***	0.211	**<0.001***	**0.94**†	**<0.001***	**1.83**†	**<0.001***	**0.86**†
SCL-90R Obss-com	2.42	0.66	1.60	0.68	0.77	0.55	**<0.001***	0.919	**<0.001***	**1.22**†	**<0.001***	**2.70**†	**<0.001***	**1.34**†
SCL-90R Int.sens.	2.60	0.69	1.60	0.71	0.67	0.61	**<0.001***	0.320	**<0.001***	**1.43**†	**<0.001***	**2.96**†	**<0.001***	**1.40**†
SCL-90R Depress.	2.89	0.61	1.99	0.69	0.97	0.65	**<0.001***	0.079	**<0.001***	**1.37**†	**<0.001***	**3.04**†	**<0.001***	**1.53**†
SCL-90R Anx	2.25	0.76	1.33	0.65	0.63	0.52	**<0.001***	**.003***	**<0.001***	**1.30**†	**<0.001***	**2.48**†	**<0.001***	**1.18**†

(continued)

Table 1. Continued

	Sg1 (n = 455)		Sg2 (n = 478)		Sg3 (n = 355)		Group		Sg1 vs Sg2		Sg1 vs Sg3		Sg2 vs Sg3	
	n	%	n	%	n	%	P		P	$\|d\|$	P	$\|d\|$	P	$\|d\|$
SCL-90R Hostility	1.83	0.93	1.05	0.71	0.54	0.58	**<0.001***	**0.003***	**<0.001***	**0.94**†	**<0.001***	**1.66**†	**<0.001***	**0.79**†
SCL-90R Pho.Anx	1.46	0.94	0.70	0.67	0.22	0.35	**<0.001***	**0.001***	**<0.001***	**0.93**†	**<0.001***	**1.74**†	**<0.001***	**0.90**†
SCL-90R Paranoia	1.95	0.76	1.18	0.67	0.58	0.54	**<0.001***	**0.022***	**<0.001***	**1.08**†	**<0.001***	**2.09**†	**<0.001***	**0.98**†
SCL-90R Psychotic	1.84	0.65	1.08	0.56	0.44	0.38	**<0.001***	0.067	**<0.001***	**1.25**†	**<0.001***	**2.62**†	**<0.001***	**1.34**†
SCL-90R GSI	2.27	0.54	1.44	0.50	0.70	0.45	**<0.001***	0.150	**<0.001***	**1.59**†	**<0.001***	**3.16**†	**<0.001***	**1.57**†
SCL-90R PST	73.5	11.4	60.0	15.0	36.1	17.6	**<0.001***	**<0.001***	**<0.001***	**1.02**†	**<0.001***	**2.52**†	**<0.001***	**1.46**†
SCL-90R PSDI	2.74	0.43	2.13	0.47	1.65	0.43	**<0.001***	**0.009***	**<0.001***	**1.36**†	**<0.001***	**2.52**†	**<0.001***	**1.06**†
TCI-R Novelty seeking	104.3	17.9	102.3	16.9	103.1	13.2	0.252	0.142	0.064	0.11	0.302	0.08	0.489	0.05
TCI-R Harm avoidance	125.7	17.9	111.6	17.1	92.4	14.8	**<0.001***	**0.008***	**<0.001***	**0.80**†	**<0.001***	**2.03**†	**<0.001***	**1.20**†
TCI-R Reward depend.	98.1	16.5	98.0	15.2	103.9	14.0	**<0.001***	**0.001***	0.911	0.01	**<0.001***	0.38	**<0.001***	0.41
TCI-R Persistence	105.2	21.4	107.0	19.2	115.1	18.9	**<0.001***	**0.007***	0.166	0.09	**<0.001***	**0.51**†	**<0.001***	0.42
TCI-R Self-directedness	103.5	14.8	120.2	13.9	145.3	15.9	**<0.001***	**<0.001***	**<0.001***	**1.17**†	**<0.001***	**2.72**†	**<0.001***	**1.68**†
TCI-R Cooperativeness	127.3	17.2	132.9	14.6	139.4	13.4	**<0.001***	0.625	**<0.001***	0.35	**<0.001***	**0.79**†	**<0.001***	0.46
TCI-R Self-transcend.	68.3	15.0	64.2	14.7	60.2	15.4	**<0.001***	0.960	**<0.001***	0.27	**<0.001***	**0.53**†	**<0.001***	0.26

Note. SD: standard deviation. LT: linear trend. QT: quadratic trend. Sg1: Subgroup 1. Sg2: Subgroup 2. Sg3: Subgroup 3. EDI-2: Eating disorder inventory-2. ED: Eating disorder. SOGS: South oaks gambling severity screen. DSM: Diagnostic Questionnaire for Pathological Gambling. GD: Gambling disorder. DERS: Difficulties in Emotion Regulation Strategies. SCL-90: Symptom Checklist-90 Items-Revised. TCI-R: Temperament and Character Inventory–Revised.

*Bold: significant comparison (0.05).

†Bold: effect size into the mild-moderate ($|d|$>0.50) to the high-large range ($|d|$>0.80).

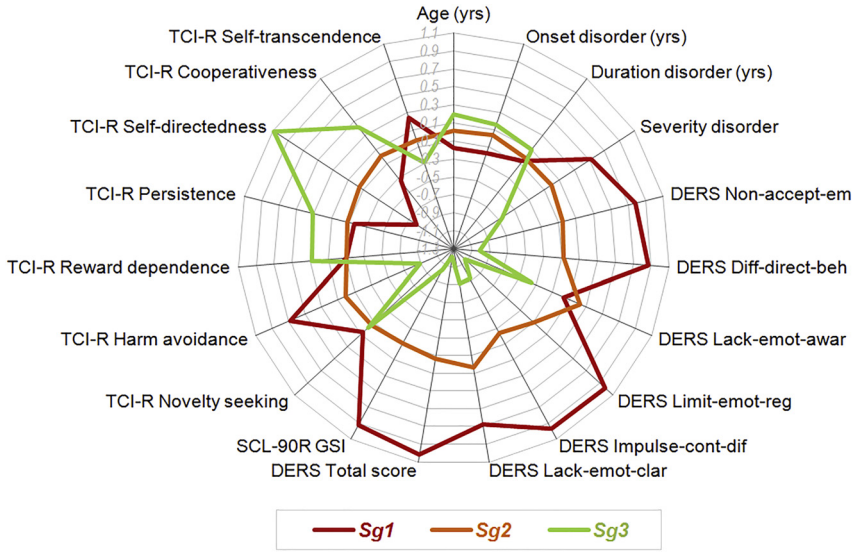

Fig. 2 Radar-chart displaying the main differences between empirical groups

Note. Sg1: Subgroup 1. Sg2: Subgroup 2. Sg3: Subgroup 3. DERS: Difficulties in Emotion Regulation Strategies. SCL-90: Symptom Checklist-90 Items-Revised. TCI-R: Temperament and Character Inventory–Revised.

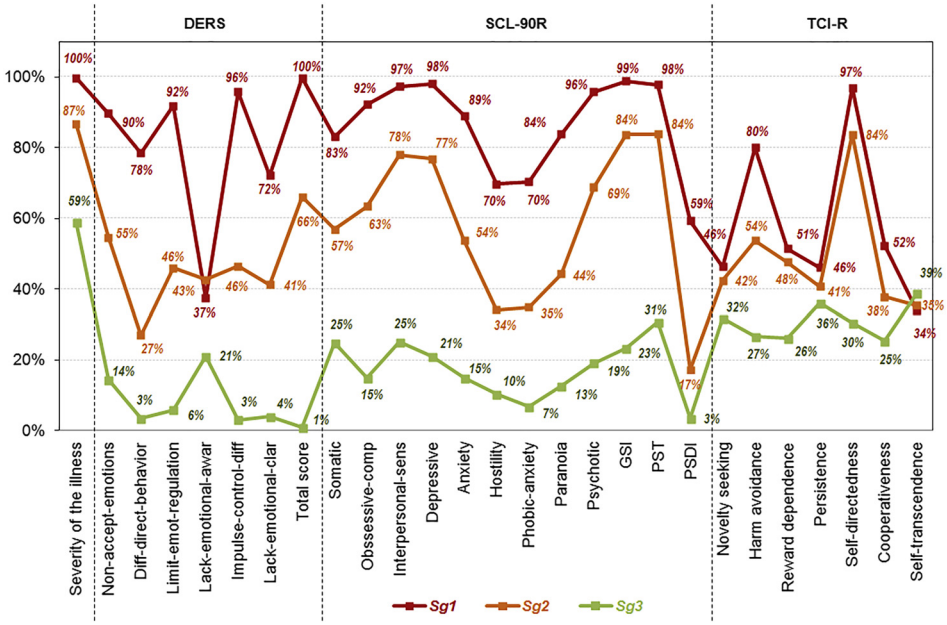

Fig. 3 Line-chart displaying the prevalence of participants into the non-normative groups

Note. Sg1: Subgroup 1. Sg2: Subgroup 2. Sg3: Subgroup 3. DERS: Difficulties in Emotion Regulation Strategies. SCL-90: Symptom Checklist-90 Items-Revised. TCI-R: Temperament and Character Inventory–Revised. GSI: Global severity index. PST: Positive symptom total. PSDI: Positive symptom distress index.

summary of the composition of the empirical latent groups in the study. Based on the set of results in this study, Sg1 was labeled *"severe profile,"* Sg2 as *"moderate profile,"* and Sg3 as "*low profile.*"

Diagnostic subtypes within the empirical latent groups

Figure 4 displays 100% stacked bar charts with the distribution of the diagnostic subtypes in the latent empirical groups. The first panel obtained for the total sample indicates that GD patients were mostly included within subgroups Sg2 and Sg3 (39.8% in each latent group), while ED patients were mostly included within latent subgroups Sg1 (41.6%) and Sg2 (36.0%). Considering the ED subtype (second panel), AN was similarly distributed across the three clusters, while BN and BED were mainly distributed across Sg1 and Sg2; the distribution for the OSFED patients was more similar to AN than to BN and BED. Regarding the GD subtypes (third panel): (a) Non-Strategic gambling was mostly included in Sg3 (48.4%) and Sg2 (39.8%); (b)

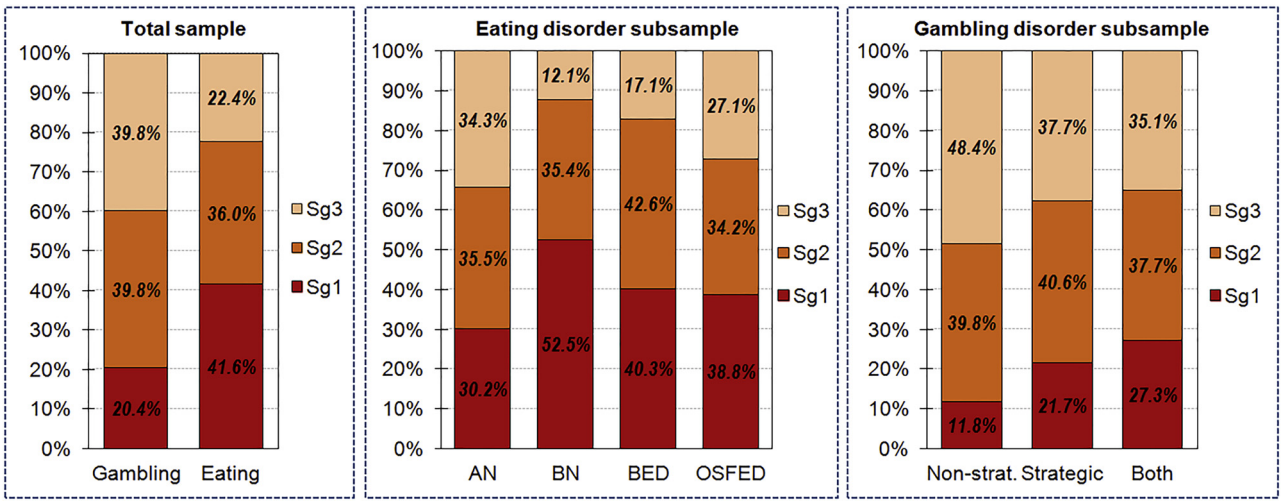

Fig. 4. Distribution of the diagnostic subtype into the empirical groups

Note. Sg1: Subgroup 1. Sg2: Subgroup 2. Sg3: Subgroup 3. AN: Anorexia nervosa. BN: Bulimia nervosa. BED: Binge eating disorder. OSFED: other specified feeding eating disorder. GD: gambling disorder. Total sample: n = 1,288. Gambling disorder subsample: n = 382. Eating disorder subsample: n = 906.

Strategic gambling was also mostly within Sg2 (40.6%) and Sg3 (37.7%), but with a higher percentage in Sg1 (21.7%) compared with Non-Strategic gambling in the same subgroup; (c) people with mixed gambling subtypes were similarly distributed across the three empirical groups: Sg1 (27.3%), Sg2 (37.7%), and Sg3 (35.1%).

DISCUSSION

The aim of the present study was to explore the existence of latent empirical groups among ED and GD, based on emotional regulation difficulties and considering personality traits, general psychopathology, and severity of the disorder. As we hypothesized, the phenotypes were defined by the degree of ER difficulties, in particular the DERS subscale *limited access to emotional regulation strategies*. There was a linear relationship between the ER profile and the severity and general psychopathological state within the disorder. The three clusters were labeled as Sg1 "*severe profile,*" Sg2 "*moderate profile,*" and Sg3 "*low profile.*"

The transdiagnostic approach is presented as a proposal that different mental disorders could share some core underlying clinical dimensions, which may have important implications in treatment (Norton & Paulus, 2016; Reinholt & Krogh, 2014). In the case of ER, it was already hypothesized, at the theoretical level, that it could be a transdiagnostic construct among several conditions (Kanakam et al., 2013; Sloan et al., 2017), especially in anxiety and mood disorders (Faustino, 2020). However, there is a lack of studies aimed at identifying the phenotypes defined by ER, evaluating jointly different clinical samples.

The findings of the present research were confirmatory of the transdiagnostic role of ER in the studied disorders, being the determinant factor that grouped both conditions beyond diagnostic criteria. ED and GD were represented within the three empirical groups.

Even though ER difficulties have already been described in ED (Brockmeyer et al., 2014; Mallorquí-Bagué et al., 2018) and GD (Granero et al., 2018; Sancho et al., 2019; Williams et al., 2012), a characterization of clusters based on ER has not been explored in previous literature. To the best of our knowledge, this is the first study to confirm a transdiagnostic approach of ER in well-defined phenotypically clinical samples.

Participants with BN, followed by BED, were categorized into the severe profile (Sg1), and the mixed group of GD (Non-Strategic and Strategic gambling activities) were also categorized into this profile. In addition to greater difficulties in ER, this group had more difficulties in the other variables that were measured. The presence of higher ER difficulties in the purgative bulimic subtypes of ED has already been described in the literature (Aloi, Rania, Caroleo, De Fazio, & Segura-García, 2017; Mallorquí-Bagué et al., 2018; Wolz et al., 2015). Likewise, in the case of GD, it has been reported that patients with both, Non-Strategic and Strategic gambling activities showed higher severity of the disorder (Susana Jiménez-Murcia, Granero, Fernández-Aranda, & Menchón, 2020). This aligns with the profile of the participants in Sg1. These results suggest that the behaviors related to the disorder (i.e., binge eating and gambling activities) may be used to avoid or suppress negative emotional states (Kassel et al., 2013; Lavender et al., 2014).

Harm avoidance was the personality trait that was increased within Sg1. Higher ER difficulties and lower self-directedness (both found in this subgroup) are associated with a poorer adherence to treatment and a poorer prognosis (Claes et al., 2012; Del Pino-Gutiérrez et al., 2017; Fernández-Aranda et al., 2006; Wolz et al., 2015). Moreover, these personality traits are associated with a worse psychopathological state and severity of the disorder (Agüera et al., 2017; Greenberg & Schoen, 2008).

Participants with BED and Strategic gamblers were mainly categorized into the moderate profile group (Sg2),

which presented a middle ER difficulty profile that followed linearity with the other studied variables. This aligns with clinical experience in which a negative mood frequently precedes binge eating episodes (Gianini, White, & Masheb, 2013; Nicholls, Devonport, & Blake, 2016). The important presence of alexithymia has been described in Strategic gamblers (Bonnaire et al., 2017) and they may use gambling to regulate internal undifferentiated emotional states (Di Trani, Renzi, Vari, Zavattini, & Solano, 2017). This is consistent with the high scores in the lack of emotional awareness DERS subscale in these participants. Nevertheless, the Sg2 cluster showed fewer dysfunctional personality traits, which may contribute to a better outcome than those in Sg1.

ER difficulties were lower in Sg3. This does not mean that AN or Non-Strategic gamblers (the participants with a higher presence in Sg3) do not present ER difficulties, but that they are not as determinant in this empirical group as in Sg1. Passive gambling (Non-Strategic) is considered to be an avoidance strategy when facing negative emotional states, rather than a search for stimulation (Sancho et al., 2019). Similarly, excessive exercise or eating restriction in AN are thought to be part of an avoidant strategy in response to difficult emotion recognition and regulation (Engel et al., 2013; Harrison, Sullivan, Tchanturia, & Treasure, 2009). Moreover, Sg3 displayed several factors associated with a better adherence to and outcome of treatment (reduced psychological distress, lowest severity of the disorder, and higher levels of functional personality traits, i.e., high persistence and self-directedness).

There was a wide variation in the age and duration of disorder within subgroups. The youngest participants and those with the earliest age of onset and the lowest duration of the disorder were found in Sg1, while the older participants with a longer duration of illness were located in Sg3. It is therefore possible that developmental factors might account for the ER problems in the younger group (Zimmer-Gembeck & Skinner, 2011), while the use of better ER strategies has been reported in older population (Kessler & Staudinger, 2009; Phillips, Henry, Hosie, & Milne, 2008).

In addition to the results explained above, the clinical relevance of the variables that explained the three phenotypes was studied. In Sg1, the scores in the measured variables were higher than the normative ranges (Derogatis, 2002; Gutiérrez-Zotes et al., 2004; Wolz et al., 2015), followed by Sg2 (except in ER difficulties), while Sg3 presented the closest percentages to the sub-clinic range in all of the variables.

There are several clinical implications that may follow from these findings. For example treatment that focuses on emotional regulation would be most appropriate for those in Sg1, while those in Sg3 might respond well to guided self-help (the first stage of a stepped care model advocated by NICE) or, given the high presence of AN patients in this group, a new therapy named "Radically Open Dialectical Behavior Therapy (RO DBT)" directed to increase emotional expressiveness, receptivity, flexibility, and inhibition of emotions (Gilbert, Hall, & Codd, 2020; Lynch, Hempel, & Dunkley, 2015), as in AN patients (Hempel, Vanderbleek, & Lynch, 2018), could be useful.

It is possible that those in Sg1 may benefit from treatments augmented by emotion regulation therapy, such as emotion regulation skill training (Adamson, Leppanen, Murin, & Tchanturia, 2018; Berking et al., 2008; Fresco, Mennin, Heimberg, & Ritter, 2013; Gratz et al., 2015; Tchanturia, Doris, Mountford, & Fleming, 2015) and mindfulness-based strategies (Hermann, Kress, & Stark, 2017; Lutz et al., 2013; Opialla et al., 2014). In addition, specific strategies may be needed to address the personality traits of this subgroup, such as high harm avoidance and low self-directedness, which are associated with low adherence to treatment. In order to target these difficulties, the use of non-conventional treatments, such as those based on new technologies, could be considered. In this line, different approaches have been adopted in ED and GD with the aim of improving ER, such as the use of serious videogames (Fernandez-Aranda et al., 2015; Lorenzetti et al., 2018; Mena-Moreno et al., 2019; Tárrega et al., 2015), mobile applications (Beck, 2017), or mindfulness (Plaza, Demarzo, Herrera-Mercadal, & García-Campayo, 2013; Sala et al., 2018).

Those in Sg2 showed ER difficulties within the normative range, but they had higher levels of disorder-related severity and general psychopathology. For instance, Cognitive Behavioral Therapy (Mallorquí-Bagué, Mena-Moreno et al., 2018), Dialectical Behavior Therapy (DBT) (Linehan, 1993), or Acceptance-Based Behavioral Therapy (Roemer, Orsillo, & Salters-Pedneault, 2008) might be more appropriate.

Finally, it is important to mention the role of gender in these phenotypes. A higher percentage of women and patients with ED were found in Sg1, whereas Sg3 was characterized by a higher presence of men and patients with GD. This is in concordance with the gender prevalence in each disorder (Jiménez-Murcia et al., 2020; Treasure, Duarte, & Schmidt, 2020), but it does not imply that gender itself determines the level of ER difficulties.

In ED, ER difficulties may be a predictor of abnormal eating behaviors in both males and females from adolescence (Hayaki & Free, 2016). Although no differences have found in the ER difficulties between females and males with ED, personality traits have been described as a mediator between ER and gender in the ED population (Agüera et al., 2019; Ambwani, Slane, Thomas, Hopwood, & Grilo, 2014). Similarly, in GD, difficulties in ER have been found in both genders, but are related to different choices in gambling subtypes. Higher rates of arousal-seeking behavior have been described as a reason why men prefer Strategic games, which might also be applied to substance-abusing recreational gamblers (Liu, Maciejewski, & Potenza, 2009). In contrast, emotional issues may underlie women's choice for Non-Strategic games (Ledgerwood & Petry, 2006).

LIMITATIONS AND STRENGTHS

The following limitations of this study need to be considered. The transdiagnostic approach was only studied in two associated disorders; for future studies, related impulse

control disorders, such as other behavioral addictions or substance use disorders, and other conditions associated with difficulties in emotional regulation would be of interest (Aldao et al., 2010; Estévez et al., 2017; Kassel et al., 2013). Unfortunately, the demographics of the participants differed in terms of gender, age, and incidence, which added complexity to the interpretation of the results.

This study also has several strengths. First, the large sample size provided high external validity. A second strength was the use of multiple measures in the clustering process. The clustering clinical data depends on the relevance of the indicator variables. It is essential that all key variables related to the constructs under study are included in the grouping process (Torgo & da Costa, 2000). In addition to the scores of the measures of emotional dysregulation, we included key features of the clinical individuals' profiles (disorder severity, global psychopathological distress, and personality traits). Two-step cluster analysis is a powerful and robust technique that can be used with dimensional data in large datasets, and this system provides the weight/relevance of each predictor in the clustering process.

CONCLUSIONS

We found a three-cluster structure between ED and GD, with emotional regulation as a transdiagnostic construct ranging from "*severe*" to "*low*" profile, with variations between clusters in the severity of the disorder, psychopathological distress, and associated personality traits. Both the identification of the clusters and their characterization according to the other relevant clinical variables offer the possibility of designing a more precise treatment approach between ED and GD. This is an important implication, considering that in other psychiatric conditions, such as anxiety and mood disorders, transdiagnostic treatments have proven to obtain positive results focusing on "core" pathological processes (Barlow et al., 2017). To the best of our knowledge, this is the first study that has confirmed the transdiagnostic approach of ER in a clinical population with a phenotype approximation in two related disorders.

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Authors' contribution: LM, SJM and FFA contributed to the development of the study concept and design. RG performed the statistical analysis. LM, IB, EC, APG aided with data collection. LM, SJM, FFA, IB and GT aided with interpretation of data and the writing of the manuscript. JT, ZA and IS revised the manuscript and provided substantial comments.

SUPPLEMENTARY MATERIAL

Supplementary data to this article can be found online at https://doi.org/10.1556/2006.2021.00017.

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